
Key Dietary Factors in Obesity Management

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Abstract

Obesity management requires the recognition of obesity, the desire of both the veterinarian and owner to treat the disease and, finally, proper recommendations with an emphasis on exercise, lifestyle and nutrition. Key dietary factors include energy restriction but no restriction of other essential nutrients, such as protein and amino acids, essential fatty acids, minerals and vitamins; a sufficient volume of food; and a proper recommendation in the distribution of food to avoid hunger and begging and thus improve the chance of success. Obesity management of dogs may differ from management of cats.

Introduction

Overweight and obesity are defined as an excess of body fat. The treatment of obesity is challenging but definitely beneficial to whole body health and life expectancy.^{1,2,3} Obesity management requires the recognition of obesity by the owner and the veterinarian, the desire of both to treat the disease,⁴ and, finally, proper recommendations with an emphasis on exercise (to stimulate fat-free mass, energy expenditure and catabolism and also to lower stress),^{5,6} lifestyle (to generate a long-term change of habits, not only a temporary dietary restriction period), and nutrition. This article will focus on the latest research findings. Considering all dietary factors, obesity management can be focused on very few major considerations. Other factors, or adjuncts, may be discussed, but their effect is usually marginal. They may be useful in situations when the owner needs extra support.

Energy

The goal is to provide an energy intake below the maintenance energy requirement (MER) based on optimal weight and body condition in order to help the body consume the energy stored in extra fat, and thus lose weight. The energy requirement for maintenance is not easy to calculate as many factors may impact it.

A large body of literature is available that identifies factors influencing the risk of obesity in both dogs and cats,^{7,8} and energy requirement, such as breed, neutering, activity, temperature, lifestyle, body weight for optimal body condition,

Glossary of Abbreviations

MER: Maintenance Energy Requirement

NRC: National Research Council

and diseases. For the first time, a meta-analysis was recently published that considered all factors in dogs.⁹ But the practical challenge still is to consider all factors in order to adjust the energy intake/allowance individually.

Reduction of energy intake is efficient to induce weight loss in any specie. Thus, a reduction of the energy intake of about 20% below the energy requirement for maintenance allows a reduction of the body weight of about 1% per week.^{10,11} Such a weight-loss rate is a reasonable goal to achieve in both dogs and cats. One must know that the rate is directly linked to the energy-intake reduction. Thus, a reduction of 50% below the energy requirement for maintenance allowed a safe weight loss rate of 2.5% per week in dogs.¹²

One of the first challenges to treat obesity is to estimate properly the optimal body weight of an individual, regardless of method used,^{13,14} and MER in order to provide the right reduced amount of energy. Determining the corresponding food amount based on this may also be challenging as the energy density is usually not written on the labels of pet foods as widely as it is for human foods.

Essential Nutrients

The goal is to provide all essential nutrients, but energy, especially protein, amino acids, essential fatty acids, minerals, and vitamins, should be provided at an amount compatible with the requirements of the optimal animal hidden inside the overweight one. The provision of all micronutrient requirements is not unique to the treatment of obesity, but it has to be emphasized that food energy intake will be reduced in order to allow weight loss. If the diet is not adapted, food intake is reduced so all nutrients are reduced at the same time, which may impair health (visible through muscle mass reduction, poor hair coat and skin quality, lower immunity, and even impaired digestion). It is good to keep in mind that requirements for all essential nutrients are still the same during the treatment of obesity. In other words, the ratio of essential nutrients to energy in the diet must be increased in the same proportion as the energy intake is decreased compared to the maintenance requirements of a healthy intact normally active adult of the same optimal body weight at

optimal body condition. In the case of a high-fiber diet, digestibility may also be impaired so that the minimal amount recommended for each nutrient is not enough, and the ratio should be further increased. Nevertheless, the main dietary limiting factor may be essential amino acids and protein intake, and it is the most documented one.

Protein

The goal is to provide enough protein and essential amino acids to recover the fat-free mass corresponding to optimal body weight and condition. Providing a high-protein diet is an older recommendation,¹⁵ but new data on the protein requirements of cats to help them maintain fat-free mass, compared to only maintaining nitrogen balance, may offer a different interpretation of the older data.

In a laboratory study, we showed from measurements of dogs in optimal condition and one year after obesity was induced that:

- First, fat mass as well as fat-free mass increased in obese dogs compared to the original optimal-weight dogs.
- Second, when comparing the body composition of obese dogs with dogs after weight loss, fat mass and also fat-free mass decreased, but in fact, these dogs returned to the baseline observed previously at the original optimal condition.
- Third, rapid weight loss may allow the return to the original optimal body weight and body composition (fat-free mass of the original body condition), even with a rapid weight loss of 2.5% per week if the diet provides enough essential nutrients.¹²

In this study, the amount of dietary protein was 103g protein/1000kcalME, with an energy allowance of 75kcalME/BM,^{0.67} which provided about 3.6 g protein/kg optimal body weight for a 10-kg Beagle. We still have no data on the optimal protein requirement of dogs of various sizes that is needed to maintain their fat-free mass, but it appears that the coverage of the National Research Council (NRC) minimal amino acid requirement together with a 12% protein diet does not allow the maintenance of fat-free mass in dogs when a 28% protein diet does.¹⁶

Recently published data suggests that dogs and cats will voluntarily consume a high-protein, low-carbohydrate diet. Data from feral cats suggests a partition of energy providing 52% from protein, 46% from fat and 2% from carbohydrates,¹⁷ while colony cats voluntarily consumed a similar energy distribution of 52% from protein, 36% from fat and 12% from carbohydrates.^{18,19} Likewise, dogs chose from offered diets an energy distribution of 30% from protein, 63% from fat and 7% from carbohydrates.²⁰

At least in cats, a measure of the protein intake required to maintain fat-free mass showed that bringing 5.2 to 6g protein per kg of (optimal) body weight appeared as a goal to achieve maintenance in adult cats.²¹ While decreasing energy intake,

the diet may need to be adjusted to increase energy from protein and decrease energy from fat and carbohydrates as the amount of protein consumed should not be lowered. It is, therefore, interesting to read these data keeping in mind the results considering only the obese state and the optimal condition that may follow an efficient weight-loss program.

Thus, old studies considering high-protein diet versus moderate-protein diet shall be revisited. As an example, a diet providing 4.2g protein/kg bodyweight^{0.67}, and so-called “high-protein diet,”²² cannot anymore really be considered a high-protein diet, and a loss of lean mass cannot be surprising. Thus, no conclusion may be considered in this case except that the protein level can be considered too low to allow for the maintenance of fat-free mass. In more recent studies, the amount of energy provided by a high-protein diet (i.e., 54% of ME, with allocation of 70% of the previously observed maintenance energy requirement) allowed the maintenance of fat-free mass during weight loss in cats.²³

Does enough protein in the diet allow ad libitum feeding and weight loss?

Providing enough protein in the diet may be beneficial and certainly a positive point for successful long-term efficiency of obesity management, but it does not by itself allow weight reduction in overweight and obese cats. If the energy intake is not restricted, which means a limited amount of food provided, weight loss may not be achieved.²⁴ High-protein, low-carbohydrate diets tend to be high in fat calories, which can contribute to excess intake and weight gain.

Starch ... Shall we lower starch and sugar?

Carbohydrates are not listed as essential nutrients,²⁵ as cats can provide adequate glucose via gluconeogenesis from protein. When reducing the energy intake, the diet is usually reduced in fat as it is the highest energy nutrient. Such a reduction allows for maintaining a larger allocation of food for the same energy amount. It also is possible to reduce digestible carbohydrates to lower the energy intake and replace energetic digestible carbohydrates by nonenergetic fiber in order to leave room for protein, as protein is essential and must be maintained.¹¹ This may result in an apparently high amount of protein in the diet. But, first, it has to be related to the amount of protein really consumed by the animal, and second, even if it is high, it is not a problem, as protein is well tolerated by carnivores such as dogs^{26,27} and cats.²⁸

Starch also is well tolerated by dogs and cats in maintenance condition, even if tolerance differs between the two species.²⁹ Starch may stimulate long-term insulin secretion, and in the case of animals in the prediabetic state, it may induce postprandial hyperinsulinemia and hypoglycemia, which stimulate hunger and anabolic metabolism, allowing

easy weight gain, and reluctance to lose weight. In the case of weight-loss reluctance, when the diet recommendation is followed and the energy restriction is properly calculated, measuring glycemia before and after a meal may be recommended. In the case of postprandial hypoglycemia in dogs and cats with hyperglycemia or diabetes, a low-starch diet may be recommended to try to achieve weight loss.

Recently, a hypothesis was published that suggests two major factors in the origin of the obesity outbreak in humans: reduced activity and reduced protein intake.³⁰ These authors suggest the same factors may be involved in the evolution of pet obesity.

Volume, Satiety and Common Sense

Depending on the diet provided, restricting the amount of energy, and thus food, to reduce energy intake can result in a very small volume of food being offered. In dry food designed for weight loss in Europe, energy density is 255-334kcalME/100g of dog food and 279-361kcalME/100g of cat food (author's data, collected in 2014). In the U.S., the range was 273-388kcalME/100g of dog food and 302-400kcalME/100g of cat food.³¹

In wet food designed for weight loss in Europe, energy-density range is 50-96 kcalME/100g of dog food and 54 to 102 kcalME/100g of cat food (author's data, collected in 2014). In the U.S., the range was 53-100kcalME/100g of dog food and 74-101kcalME/100g of cat food.³¹

The ways to lower the energy density of a diet are all related to the increase of nonenergetic components:

- 1 — Water, meaning wet food or maybe adding zucchini,
- 2 — Insoluble Fiber, which is possible in both wet and dry food,
- 3 — Ash, which is not really possible as excessive mineral intake may be detrimental to health, and
- 4 — Air, whereby dry foods are “puffed” so there is more volume and less weight per cup of food, which does not really lower the energy density in energy per weight but can provide an illusion for the pet owner as it lowers the energy per volume.

In dogs, the main technique is the increase of insoluble fiber. If the other dietary criteria already discussed are respected, it is an efficient method^{12,32,33} to achieve safe weight loss. Scale weighing the daily amount of food, splitting the restricted amount of diet into several meals (i.e., morning, evening when owners return home and later in the evening), and adding water to kibbles are all useful in respecting the daily food allowance in dogs.

In practice, restricting the amount of food allocated is always a challenge for the owner of an overweight pet. To change habits must involve a commitment from the owner, yet it can still be difficult to follow. Cat owners reported that feeding partly wet food lowered the begging behavior and made long-term weight loss easier.³⁴ In our own experience,

providing at least a large portion of the diet as wet food designed for weight loss or adding zucchini to a diet has a positive impact. Zucchini is shredded, then added to the diet in gradually increasing amounts up to 25 grams of zucchini per kg of body weight per day. Feeding wet food also has been shown to increase activity in healthy cats³⁵ and to lower regain after weight loss.³⁶

One has to go back to the amount of diet that is fed. The native regimen of people and animals is mainly wet food containing about 1kcalME/gram. So when considering the MER of an intact active healthy cat (70kcalME/kg optimal body weight) or dog (130kcalME/kg body weight^{0.75}), one can consider the amount of calories obtained from this equation is about the amount of grams an animal could expect to eat per day as native wet food. This can be used as a general approach to the amount (in grams not in calories) of wet pet food to provide.

What About Treats?

As 89% of dog owners give treats on a regular if not daily basis,⁷ it is critical not to ignore the importance of treats in the human-animal relationship. It seems that the preweight loss habits do not impact a proper weight-loss program and diet.³⁷ From our own experience, these habits may be incorporated in the weight-loss program quite easily in dogs. For owners who provide treats, including a limited list of low-calorie treats and other precise guidelines (i.e., amount of treats and food allowed per day, limiting treats to 10% of the total energy intake) will help them follow the planned program. Then, the overall energy restriction may still be efficient.

Others – Adjunct Factors

L-carnitine is derived from sulfur amino acids and used to facilitate the transfer of fatty acids across the mitochondrial walls. Its biosynthesis occurs widely in the body, but it is considered a useful ergogenic adjunct in all situations of negative energy balance such as high-intensity exercise and weight loss.^{38,39} Studies are lacking to evaluate the value of L-carnitine when enough protein and sulfur amino acids are included in the diet during weight loss. Various dietary supplements have been used and are offered, yet few are supported by adequate data,⁴⁰ thus such adjuncts must be used with caution and certainly not as the primary or only approach to obesity management. Each one should be examined by looking at its safety and efficacy in double-blind controlled studies in the target specie and in the context of proper coverage of the dietary factors that can be defined as gold standard of obesity management.

References

1. Bouthegourd JC, Kelly M, Clety N, et al. Effect of Weight Loss on Heart Rate Normalization and Increase in Sponta-

- neous Activity in Moderately Exercised Overweight Dogs. *Intern J Appl Res Vet M.* 2009;7(4):153-164.
2. Impellizeri JA, Tetrack MA, Muir P. Effect of Weight Reduction on Clinical Signs of Lameness in Dogs with Hip Osteoarthritis. *J Am Vet Med Assoc.* 2000;216(7):1089-1091.
3. Lawler DF, Larson BT, Ballam JM, et al. Diet Restriction and Ageing in the Dog: Major Observations Over Two Decades. *Brit J Nutr.* 2008;99(4):793-805.
4. Sandøe P, Palmer C, Corr S, et al. Canine and Feline Obesity: A One Health Perspective. *Vet Rec.* 2014;175(24):610-616.
5. Mlacnik E, Bockstahler BA, Müller M, et al. Effects of Caloric Restriction and a Moderate or Intense Physiotherapy Program for Treatment of Lameness in Overweight Dogs with Osteoarthritis. *J Am Vet Med Assoc.* 2006;229(11):1756-1760.
6. Wakshlag JJ, Struble AM, Warren BS, et al. Evaluation of Dietary Energy Intake and Physical Activity in Dogs Undergoing a Controlled Weight-Loss Program. *J Am Vet Med Assoc.* 2012;240(4):413-419.
7. Colliard L, Ancel J, Benet JJ, et al. Risk Factors for Obesity in Dogs in France. *J Nutr.* 2006;136:1951S-1954S.
8. Colliard L, Paragon BM, Lemuet B, et al. Prevalence and Risk Factors of Obesity in an Urban Population of Healthy Cats. *J Feline Med Surg.* 2009;11:135-140.
9. Bermingham EN, Thomas DG, Cave NJ, et al. Energy Requirements of Adult Dogs: A Meta-Analysis. *PLoS ONE.* 2014;9(10):e109681.
10. German AJ, Holden SL, Bissot T, et al. Dietary Energy Restriction and Successful Weight Loss in Obese Client-Owned Dogs. *J Vet Intern Med.* 2007;21(6):1174-1180.
11. German AJ, Holden S, Bissot T, et al. Changes in Body Composition During Weight Loss in Obese Client-Owned Cats: Loss of Lean Tissue Mass Correlates with Overall Percentage of Weight Lost. *J Feline Med Surg.* 2008;10(5):452-459.
12. Blanchard G, Nguyen P, Gayet C, et al. Rapid Weight Loss with a High-Protein Low-Energy Diet Allows the Recovery of Ideal Body Composition and Insulin Sensitivity in Obese Dogs. *J Nutr.* 2004;134(8 Suppl):2148S-2150S.
13. Witzel AL, Kirk CA, Henry GA, et al. Use of a Novel Morphometric Method and Body Fat Index System for Estimation of Body Composition in Overweight and Obese Dogs. *J Am Vet Med Assoc.* 2014a;244(11):1279-1284.
14. Witzel AL, Kirk CA, Henry GA, et al. Use of a Morphometric Method and Body Fat Index System for Estimation of Body Composition in Overweight and Obese Cats. *J Am Vet Med Assoc.* 2014b;244(11):1285-1290.
15. Burkholder WJ, Bauer JE. Foods and Techniques for Managing Obesity in Companion Animals. *J Am Vet Med Assoc.* 1998;212(5):658-662.
16. Wakshlag JJ, Barr SC, Ordway GA, et al. Effect of Dietary Protein on Lean Body Wasting in Dogs: Correlation Between Loss of Lean Mass and Markers of Proteasome-Dependent Proteolysis. *J Anim Physiol An N (Berl).* 2003;87(11-12):408-420.
17. Plantinga EA, Bosch G, Hendriks WH. Estimation of the Dietary Nutrient Profile of Free-Roaming Feral Cats: Possible Implications for Nutrition of Domestic Cats. *Brit J Nutr.* 2011;106(Suppl 1):S35-S48.
18. Hewson-Hughes AK, Hewson-Hughes VL, Miller AT, et al. Geometric Analysis of Macronutrient Selection in the Adult Domestic Cat, *Felis Catus*. *J Exp Biol.* 2011(15);214(Pt 6):1039-1051.
19. Hewson-Hughes AK, Hewson-Hughes VL, Colyer A, et al. Consistent Proportional Macronutrient Intake Selected by Adult Domestic Cats (*Felis Catus*) Despite Variations in Macronutrient and Moisture Content of Foods Offered. *J Comp Physiol B.* 2013;183(4):525-536.
20. Hewson-Hughes AK, Hewson-Hughes VL, Colyer A, et al. Geometric Analysis of Macronutrient Selection in Breeds of the Domestic Dog, *Canis Lupus Familiaris*. *Behav Ecol.* 2013;24(1):293-304.
21. Laflamme DP, Hannah SS. Discrepancy Between Use of Lean Body Mass or Nitrogen Balance to Determine Protein Requirements for Adult Cats. *J Feline Med Surg.* 2013;15(8):691-697.
22. Vasconcellos RS, Borges NC, Gonçalves KN, et al. Protein Intake During Weight Loss Influences the Energy Required for Weight Loss and Maintenance in Cats. *J Nutr.* 2009;139(5):855-860.
23. Des Courtis X, Wei A, Kass PH, et al. Influence of Dietary Protein Level on Body Composition and Energy Expenditure in Calorically Restricted Overweight Cats. *J Anim Physiol An N (Berl).* 2014. doi: 10.1111/jpn.12239. (Epub ahead of print)
24. Wei A, Fascetti AJ, Liu KJ, et al. Influence of a High-Protein Diet on Energy Balance in Obese Cats Allowed *Ad Libitum* Access to Food. *J Anim Physiol An N (Berl).* 2011;95(3):359-367.

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25. Nutrient Requirements of Dogs and Cats. National Research Council. The National Academies Press. Washington, D.C. 2006:424.
26. Williams CC, Cummins KA, Hayek MG, et al. Effects of Dietary Protein on Whole-Body Protein Turnover and Endocrine Function in Young-Adult and Aging Dogs. *J Anim Sci.* 2001;79(12):3128-3136.
27. Laflamme DP. Pet Food Safety: Dietary Protein. *Top Companion Anim M.* 2008;23(3):154-157.
28. Green AS, Ramsey JJ, Villaverde C, et al. Cats Are Able to Adapt Protein Oxidation to Protein Intake Provided Their Requirement for Dietary Protein Is Met. *J Nutr.* 2008;138(6):1053-1060.
29. Hewson-Hughes AK, Gilham MS, Upton S, et al. The Effect of Dietary Starch Level on Postprandial Glucose and Insulin Concentrations in Cats and Dogs. *Brit J Nutr.* 2011;106(Suppl 1):S105-S109.
30. Raubenheimer D, Machovsky-Capuska GE, Gosby AK, et al. Nutritional Ecology of Obesity: From Humans to Companion Animals. *Brit J Nutr.* 2015;113;S26-S39.
31. Linder DE, Freeman LM. Evaluation of Calorie Density and Feeding Directions for Commercially Available Diets Designed for Weight Loss in Dogs and Cats. *J Am Vet Med Assoc.* 2010;236(1):74-77.
32. Diez M, Michaux C, Jeusette I, et al. Evolution of Blood Parameters During Weight Loss in Experimental Obese Beagle Dogs. *J Anim Physiol An N (Berl).* 2004;88(3-4):166-171.
33. German AJ, Holden SL, Bissot T, et al. A High Protein High Fibre Diet Improves Weight Loss in Obese Dogs. *Vet J.* 2010;183:294-297.
34. Bissot T, Servet E, Vidal S, et al. Novel Dietary Strategies Can Improve the Outcome of Weight Loss Programmes in Obese Client-Owned Cats. *J Feline Med Surg.* 2010;12(2):104-112.
35. Deng P, Iwazaki E, Suchy SA, et al. Effects of Feeding Frequency and Dietary Water Content on Voluntary Physical Activity in Healthy Adult Cats. *J Anim Sci.* 2014;92(3):1271-1277.
36. Cameron KM, Morris PJ, Hackett RM, et al. The Effects of Increasing Water Content to Reduce the Energy Density of the Diet on Body Mass Changes Following Caloric Restriction in Domestic Cats. *J Anim Physiol An N (Berl).* 2011;95(3):399-408.
37. German AJ, Holden SL, Gernon LJ, et al. Do Feeding Practices of Obese Dogs, Before Weight Loss, Affect the Success of Weight Management? *Brit J Nutr.* 2011;106(Suppl 1):S97-S100.
38. Blanchard G, Paragon BM, Milliat F, et al. Dietary L-Carnitine Supplementation in Obese Cats Alters Carnitine Metabolism and Decreases Ketosis During Fasting and Induced Hepatic Lipidosis. *J Nutr.* 2002;132(2):204-210.
39. Center SA, Harte J, Watrous D, et al. The Clinical and Metabolic Effects of Rapid Weight Loss in Obese Pet Cats and the Influence of Supplemental Oral L-Carnitine. *J Vet Intern Med.* 2000;14(6):598-608.
40. Roudebush P, Schoenherr WD, Delaney SJ. An Evidence-Based Review of the Use of Nutraceuticals and Dietary Supplementation for the Management of Obese and Overweight Pets. *J Am Vet Med Assoc.* 2008;232(11):1646-1655.