

Improving your Weight Loss Success

The Healthy Weight Protocol in Practice

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At a Glance

- The Healthy Weight Protocol was developed to make weight loss therapy more successful by providing accurate body composition data that results in calculation of more effective food dose for weight loss.
- The Healthy Weight Protocol required extensive development over several years – beginning with sound science and rigorous university supervised animal studies followed by extensive data analysis and mathematical modeling.
- The Healthy Weight Protocol is the most effective way for the practitioner to diagnose body composition and ideal weight in overweight and obese pets. It is a vast improvement over body condition scoring.
- Healthy Weight Protocol is easy to learn and implement in practice. In the first 9 months following the launch of the Healthy Weight Protocol in the United States and Canada, it has been used on over 150,000 patients in over 10,000 clinics.
- The Healthy Weight Protocol digital tools are available via a website (www.hwp.hillsvet.ca) or smartphone app (iPhone/iPad, Android).

Background

Obesity in pet dogs and cats is a highly prevalent and growing problem.¹ Recent Studies indicate that between 25% and 40% of pet cats are overweight or obese.²⁻⁵ Likewise, approximately 30% to 40% of pet dogs are overweight and between 5% and 20% are obese.⁶⁻⁸ Obese pets, like obese people, experience a wide variety of health problems. In cats, obesity is associated with metabolic and endocrine disorders (including diabetes), oral disease, and lower urinary tract diseases, as well as decreased longevity.⁹⁻¹⁰ In dogs, obesity has been linked to insulin resistance, orthopedic disorders, cardiorespiratory disease, urogenital dysfunction, neoplasia, and several functional alterations.¹¹⁻¹³ The magnitude and seriousness of this disease demands effective action by the veterinary community to assure the health and wellbeing of the pet population.

To effectively treat obese animals, veterinarians must be able to accurately assess body composition and ideal weight; however no accurate, practical methods of measuring body composition are available for in-clinic use. Although a body condition score (BCS) can be useful to determine if a pet is at a healthy weight, too thin, or too fat, it lacks the resolution required to determine ideal body weight and an effective feeding plan. BCS systems are also subjective and rely on palpation and visual assessment to assign a score to patients to place them in a percent body fat range. The result is that all obese pets are grouped together, irrespective of the extent of their obesity. Further, the BCS methods in current use were developed and validated in animals with less than 45% body fat which excludes the morbidly obese pets that most need therapy.

When compared to Dual Energy X-ray Absorptiometry (DEXA), the “Gold Standard” for noninvasive assessment of body composition, BCS accurately predicted body fat (within 10% of the DEXA value) in only 15% of canine

patients and 13% of feline patients. Clearly, successful weight loss therapy will require better body composition methods.

Healthy Weight Protocol

The Healthy Weight Protocol was developed to provide practicing veterinarians a diagnostic tool to effectively estimate body fat and ideal weight in overweight pets. This information is essential to develop an effective weight loss plan. The Healthy Weight Protocol morphometric tool uses simple measurements of body size and shape (Morphometric Measurements) and a mathematical equation to predict body composition variables.

Rationale

The use of morphometric measurements to predict body composition is based on the assumption that for a given species, lean body mass is a function of body frame size. Where there is a high level of diversity of body conformation (or frame type), as in the canine species, some indicator of body conformation is also needed for good accuracy. If frame size can be estimated (measured) with reasonable accuracy, lean body mass can also be predicted. Body fat mass and percent body fat can be calculated if body weight is also measured. Finally, ideal body weight can be calculated by assuming 20% body fat is ideal.⁹

Theoretical considerations

The prediction of body composition from morphometric measurements requires accurate & repeatable measurement of parameters that are related to frame size and shape.

Therefore the parameters must be:

- Simple & easily measured on a live animal regardless of level of body fat. The value of the parameter cannot be influenced by body position or movement. Measurements that require palpation of anatomical landmarks that may be covered by a thick layer of body fat suffer from both poor accuracy and precision (repeatability).
- Precise. When a parameter is measured multiple times the result must be the same (or very nearly the same). Further, when a parameter is measured by multiple individuals the result must be the same (or very nearly the same).

The wide diversity of body conformation within the canine species requires measurement of parameters indicative of body type or conformation. Measurement of the diameter or circumference of various body structures can provide some of this information. Data transformation (e.g. calculation of an area from a diameter) and calculation of new parameters (e.g. creating a volume from a length and diameter) may provide valuable body type or conformation information.

Development of Healthy Weight Protocol Methods

Two studies in dogs and two in cats were done at the University of Tennessee to collect the data to develop the Healthy Weight Protocol methods. Dual Energy X-ray Absorptiometry (DEXA) was performed on each patient to provide an accurate measurement of body fat and lean. A large number of morphometric measurements (some previously reported & some new) were done multiple times by multiple individuals. Having duplicate data from multiple individuals allowed assessment of the variability of each measurement. Full details of these studies are reported elsewhere.

In addition to the primary measurements, a group of calculated parameters were also created to provide estimates of body shape. Over 50 calculated parameters were developed based on fundamental geometry and science principles. These parameters includes ratios of one measurement to another (e.g. head length / leg length) and products of two measurements (e.g. head diameter x head length). All of these variables were used in the statistical analysis to develop the predictive models.

Statistical analysis

Hundreds of hours were spent on data processing and analysis to create the Healthy Weight Protocol's morphometric tool's predictive equations.

Mathematical models for prediction of each of the body composition variables were developed using multiple regression analysis. Both stepwise and SBC procedures were used. Multiple iterations were done using different combinations of primary measurements & calculated variables.

Models were initially evaluated based on correlation of the predicted values to the DEXA results. Multiple models had very high correlation coefficients (r -squared > 0.95). However, high correlation does not assure accuracy. It is possible to have high correlation but poor accuracy. If equal numbers of animals are over & under predicted by similar amounts then correlation may be high however accuracy may be poor for a significant number of animals. Therefore, accuracy was evaluated for each model by calculating the percent of values that were predicted within + or - 10 percent of the DEXA result for the corresponding variable.

Model evaluation & refinement

Initially for dogs, two models (one for dogs < 40 lbs & another for dogs 40 lbs & above) were needed for a high level of accuracy. These models were then used in a global field study with over 120 veterinarians to assess the practicality of use in routine practice. Additionally a second research study was conducted at University of Tennessee to provide a second dataset to validate and refine the models.

Following the field study and the second research study at the University of Tennessee, the data was analyzed again to further refine and optimize the models. Measurements that were difficult to do and were highly variable were eliminated. New models were developed from the first dataset and validated with the second dataset. Models were also developed from the second dataset and validated using the first dataset. The best model (highest level of accuracy) was then revised with the data from both studies to produce the final equation now in use in the Healthy Weight Protocol's morphometric tool.

Effectiveness

The Healthy Weight Protocol's morphometric tool was developed to be highly effective across a wide range of breeds, body shapes, and sizes, however it does have some limitations:

- It was developed using overweight and obese animals. It will not be accurate for pets with <25% body fat.
- A limited number of animals were studied. The group of animals studied was very diverse; however, there will always be some outliers. Fortunately there should be very few and the magnitude of errors in prediction should not be large.

- Measurement and data entry errors can have a large effect on the accuracy of the results:
 - Because the model uses multiple variables, multiple measurement errors are magnified in the result.
 - Small measurement errors have a greater effect on small animals. For example: a half cm error on a 10 cm measurement (5%) has greater impact than a half cm error on a 20 cm measurement (2.5%).

Despite some potential limitations, the Healthy Weight Protocol’s morphometric tool is a vast improvement over previous methods available to the practitioner. The performance of body condition scoring to predict lean body mass is poor at best, especially for grossly obese patients. In the studies used to develop the Healthy Weight Protocol, body condition scoring was only accurate in predicting body fat (within +/- 10% of the DEXA result) in 13% of cats and 15% of dogs. Even worse, it under-predicted the percent body fat by >20% more than 50% of the time for both dogs and cats. Under estimation of body fat results in over prediction of ideal body weight and food dose often resulting in a failure to achieve weight loss. The Healthy Weight Protocol morphometric tool was far more accurate (see table below).

Table 1. Accuracy vs. DEXA for Lean Body Mass Prediction

Comparison to DEXA Value	Cat	Dog
Underestimated by >20%	0.0%	1.2%
Underestimated by 11-20%	5.3%	4.8%
Within 10%	86.8%	79.5%
Overestimated by 11-20%	7.9%	13.3%
Overestimated by >20%	0.0%	1.2%

Use in Clinical Practice

Because nutrition is integral to weight management, it is critical to incorporate a nutritional assessment and specific nutrition recommendation for every pet. In order to give healthcare teams a roadmap to implement these guidelines, WSAVA launched Global Nutrition Guidelines and provides practical online tools. (www.WSAVA.org).^{14, 15} Based on the nutritional assessment screening evaluation which includes body weight, body condition score and nutritional history, every pet can be categorized as either underweight, normal weight or overweight. Overweight pets should be further evaluated using the Healthy Weight Protocol to determine how overweight they are and to establish their Ideal Body Weight (IBW). Ideal Body Weight being defined as 20% body fat.

Having an accurate estimate of Ideal Body Weight (IBW) is essential for development of a successful weight loss plan. Because body fat does not consume calories, calculation of resting energy requirement (RER) and the daily caloric allowance for weight loss are based on IBW, not the inflated current weight of an overweight or obese animal. Often the IBW will also be used as the weight loss goal or Target Body Weight. However, in some cases a veterinarian may feel like the IBW might be too low for a given patient and may choose stop weight loss before the pet reaches that level (about 20% body fat). Even if the veterinarian chooses to establish a higher Target Weight it is essential that the IBW is used for all food dose calculations. If an inflated IBW is used for food dose calculations, weight loss will likely be slow or ineffective. If the diagnosed IBW is actually too low (significantly < 20% body fat) resulting in a food dose that is too low, weight loss may occur faster than

expected. In the unlikely event this does happen, it will be noticed at one of the first few recheck visits and food dose can be increased if needed.

Healthy Weight Protocol Guidelines

At the time of writing the Healthy Weight Protocol tools have been used to diagnose and develop treatment plans for over 150,000 cats and dogs. The following guidelines were developed from evaluation of this vast dataset and feedback from many of the over 12,500 practitioners currently using the tools.

With the Healthy Weight Protocol, we recommend that you DO:

- Complete a Nutritional Assessment Screening Evaluation on every patient
- Use the morphometric tool on overweight and obese patients (if otherwise healthy)
- Use the output of the tool to change the conversation with the pet owner. Talk about excess body fat and related health risks.
- Use the predicted ideal weight to establish your initial feeding dose for weight loss. Increase the feeding amount recommendation if the pet is losing weight too quickly or decrease the food dose if it is losing too slowly.
- Use your professional experience and judgment to assess the tool's output (ideal weight and BFI) and adjust if needed
- Double check your measurements and ensure you enter them correctly into the digital tools. Take extra care measuring smaller breeds as errors or inaccuracies will have a more dramatic effect on the tool's output
- Use the Hill's BFI Risk Chart if you are unable to take reliable measurements
- Use the digital tools to develop feeding plans for pets already at a healthy weight. All Hill's Science Diet, Prescription Diet and Ideal Balance products are included.

With the Healthy Weight Protocol, we recommend that you DO NOT:

- Use the morphometric measurement tool as a screening device to determine whether or not the pet is overweight. First complete a Nutritional Assessment Screening Evaluation including patient's Body Condition Score
- Use the morphometric measurement tool on healthy weight or underweight patients
- Use terms such as obese or fat with a clients
- Use the morphometric measurement tool to track a patient's progress. Measurements should only be done once. Once the initial ideal body weight is identified, use the pet's current body weight to assess progress against the goal.

Future

With such an extensive amount of detailed canine and feline breed information, Hill's will be working on optimizing the morphometric measurements to better account for specific breed, gender and body type characteristics. These revisions will improve overall measurement accuracy through enhanced error messaging as well as provide more detailed information on outlier animals. These planned enhancements are expected in late 2014.

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