A Simple, Reliable Tool for Owners to Assess the Body Condition of Their Dog or Cat[1–3]

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EXPANDED ABSTRACT

KEY WORDS: • *body composition* • *obesity* • *dual-energy X-ray absorptiometry* • *canine* • *feline*

Numerous methods exist for quantifying body composition and body fat mass in companion animals. In a clinical setting, the most widely accepted and practical method of body condition evaluation is condition scoring using visual assessment and palpation (1). All such systems attempt to partition a body composition continuum into a finite number of categories. Currently, 3 main systems exist, all of which use similar visual and palpable characteristics, but which differ by the number of integer categories within the scoring system (e.g., 5 points, 6 points, and 9 points) (2–8). The most widely accepted system is the 9-integer scale system, which has previously been shown to correlate well with body fat mass determined by dual-energy X-ray absorptiometry (DXA) (2–4). To aid decision making, a series of animal silhouettes are also provided that illustrate the visual characteristics for a typical (e.g., Labrador' morphology) dog and cat. Scores determined by different operators have also been shown to correlate well (2–4), although a degree of expertise is required, rendering this system less accessible to untrained pet owners.

S.H.A.P.E (Size, Health And Physical Evaluation) is a new algorithm-based system that uses similar visual and palpable characteristics as existing scoring systems (see http://www.pet-slimmers.com/shape.htm). A series of questions are followed that direct the operator to examine the animal in a sequential fashion. The questions instruct the operator to perform examinations that will determine the presence and amount of subcutaneous fat (over the ribcage and spine, etc.), and the amount of abdominal fat (by determining the presence and degree of abdominal tuck). Ultimately, 1 of 7 categories of body condition is chosen, each of which is assigned an alphabetical character from A (underweight) to G (obese). Letters were chosen for this new system to avoid confusion with current body condition score systems. This approach is designed to minimize interoperator variability and expertise required, allowing owners to evaluate their animals in the home and consult the veterinarian accordingly.

The aim of the current study was to assess the performance of the algorithm system in predicting body composition in dogs and cats, and to acquire preliminary data on how the system performed in the hands of both experienced and inexperienced operators.

MATERIALS AND METHODS

Seventy-one dogs and 20 cats, referred to the Small Animal Hospital, University of Liverpool, participated in the study. To ensure that subjects represented as broad a range of body composition as possible, 2 populations were recruited. The first population comprised cases referred for investigation into management of obesity (24 dogs, and 14 cats); the second population was recruited from the same hospital population with a variety of other disorders (47 dogs, and 6 cats). Aside from 1 cat (referred for investigation of weight loss) and 4 dogs (referred for investigation of jaundice, abdominal pain, chronic renal insufficiency, and poorly stabilized diabetes mellitus, respectively), all cases in group 2 were referred for investigation of orthopedic disease. The median (range) age of dogs in groups 1 and 2 was 64 mo (range 27–157) and 46 mo (range 5–132), respectively; the median age of cats in groups 1 and 2 was 96 mo (range 24–180) and 54 mo (range 5–109), respectively. A range of genders was represented in both groups (male and female, entire and neutered for dogs; male and female neutered for cats). Aside from 1 Siamese (group 1), 1 Burmese (group 2) and 1 British shorthair (group 2), all cats were domestic

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shorthair. A range of sizes of dog breeds was represented in both groups, including Labrador retriever, crossbred, Rottweiler, Golden retriever, Dalmatian, collie, Newfoundland, Great Dane, Bernese Mountain dog, Poodle, German Shepherd dog, Cocker spaniel, Springer spaniel, and Cavalier King Charles Spaniel. Labradors represented the most common breed in both groups ($n = 8$, group 1; $n = 15$, group 2). The study was performed in adherence to the University of Liverpool animal ethics guidelines and the owners of all animals participating in the study gave written consent.

Two investigators (AG and SH), with experience at body condition scoring, independently assessed all of the animals in the study, with a newly developed 7-point algorithm system (http://www.pet-slimmers.com/shape.htm). In addition, 1 operator (SH) also used a previously validated 9-point body condition scoring system that incorporated silhouettes (2,3). The order of scoring (7-point algorithm system vs. 9-point silhouette system) was randomized to minimize the effect of bias. In addition, the owners of the cases referred for investigation of obesity independently scored their respective animals. In this regard, the 7-point algorithm system and operating instructions were sent to owners before their appointment. Owners placed their results in sealed envelopes, and these were only viewed by the investigators after all scoring was completed.

All animals in the study had detailed investigations appropriate to their clinical signs. During these investigations, cases referred for investigation of obesity were sedated for quantification of body fat by DXA. DXA was also performed on cases referred for other reasons, at the time of sedation or anesthesia for another diagnostic procedure (e.g., X-ray). All subjects were scanned in dorsal recumbency with a fan-beam DXA (Lunar Prodigy Advance, GE Lunar). Data analysis used prespecified protocols with computer software (enCORE 2004, 8.70.005; GE Lunar).

Statistical analysis was performed with Minitab for Windows, release 14.1 (Minitab). Before statistical analysis, body fat data were first assessed for and confirmed to be of normal distribution. The effect of body condition score (7-point algorithm system [determined by SH] or 9-point silhouette system) on body fat percentage was assessed with simple regression (9). In order to enable statistical analysis to be performed on the algorithm system scores, the alphabetical characters were replaced with integers, e.g., A(1) through G(7). Given that all condition scores represented discontinuous data, associations between different investigators were assessed with the Spearman correlation coefficient (9). The level of significance for all statistical tests was set at $P < 0.05$.

RESULTS

Correlation between the experienced operators was excellent for both dogs ($R_s = 0.957$, $P < 0.0001$) and cats ($R_s = 0.987$, $P < 0.0001$). Correlation between the owner-determined 7-point algorithm system score and scores determined by both experienced operators was also good for dogs ($R_s = 0.823$, $P < 0.0001$ and $R_s = 0.830$, $P < 0.0001$ for owners vs. AG and SH, respectively), and cats ($R_s = 0.864$, $P < 0.0001$ and $R_s = 0.867$, $P < 0.0001$ for owners vs. AG and SH, respectively).

The scores of the owners using the algorithm system agreed on 29 of 38 (76%) and 30 of 38 (79%) occasions with those of the experienced operators (AG and SH, respectively). When scores disagreed, they were always within 1 integer category of each other, and owners over- and underestimated scores an approximately equal number of times. Other than on 2 occasions, the disagreement was between assigning integer scores of 6 and 7. The 2 exceptions included 2 owners that scored their animals as 5/7 and 6/7, respectively, whereas both experienced operators scored the same animals as 4/7 and 5/7, respectively. The algorithm system scores of the 2 experienced operators agreed on 82 of 91 (90%) occasions and scores were always within 1 integer category of each other. Most of the disagreements were for animals with algorithm system scores of 3–5/7.

Simple regression analysis demonstrated a significant association between body condition, as determined by the 7-point algorithm system, and body fat percentage in both dogs ($R^2 = 0.833$, $P < 0.0001$, **Fig. 1***A*) and cats ($R^2 = 0.833$, $P = 0.0001$, **Fig. 2***A*). These results were similar to the association between the 9-point silhouette system score and body fat percentage (dogs $R^2 = 0.836$, $P < 0.0001$, Fig. 1*B*; cats $R^2 = 0.808$, $P < 0.0001$, Fig. 2*B*).

DISCUSSION

The current study has validated a new 7-category algorithm-based body condition scoring system for companion animals. Although a number of methods already exist, all require prior training, and the silhouettes provided often complicate the assessment. Decision making in the algorithm system is more objective and shows reproducibility among operators. The correlation achieved in the current study was equivalent to that demonstrated when the most widely used of the current systems, the 9-point silhouette system, is used (2–4). From the current data it is impossible to say which of the 2 systems is superior; but this was not the purpose of our study. To our knowledge, no other studies have assessed head-to-head performance between the 9-point silhouette system and the new

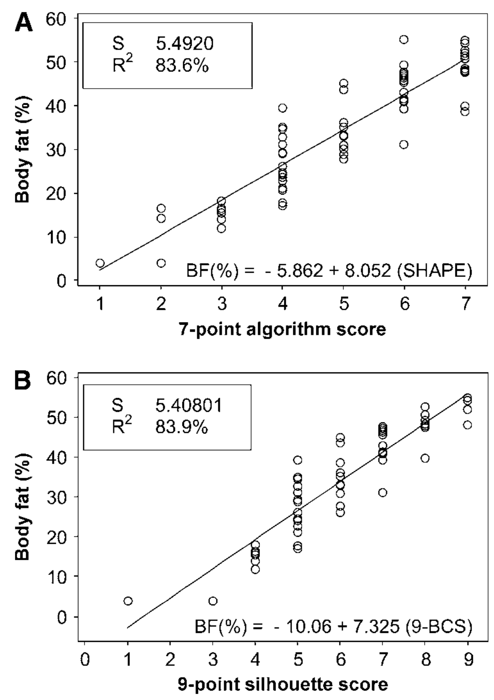

FIGURE 1 Relation between estimated body fat percentage and body condition scores in dogs. Association between estimated percentage of body fat, determined by dual energy X-ray absorptiometry (DXA), and body condition score determined by the 7-point algorithm system. There is a highly significant association between the algorithm system score and estimated body fat percentage ($P < 0.0001$) (*A*). Association between estimated percentage of body fat, determined by DXA, and body condition score determined by the 9-point silhouette system (2) (*B*). Again, there is a highly significant association between body condition score determined by the 9-point silhouette system and estimated body fat percentage ($P < 0.0001$). S represents the estimated standard deviation of the error in the model. R^2 represents the coefficient of determination, which indicates how much variation in the response is explained by the model; the higher the R^2, the better the model fits the data. Data was analyzed by simple linear regression.

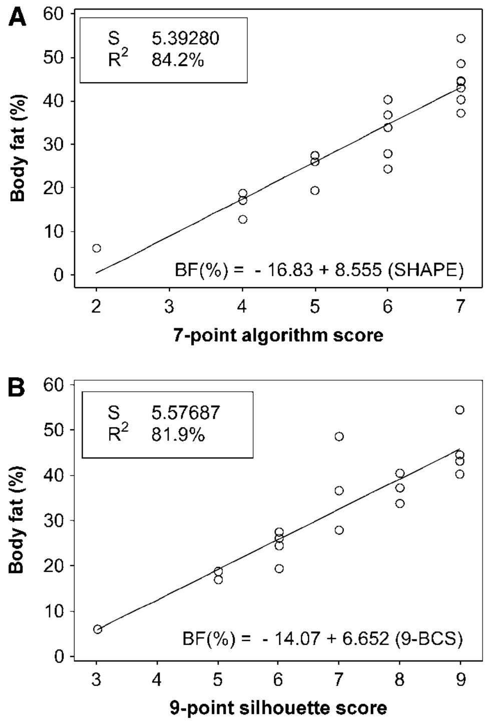

FIGURE 2 Relation between estimated body fat percentage and body condition scores in cats. Association between estimated percentage of body fat, determined by dual energy X-ray absorptiometry (DXA), and body condition score determined by the 7-point algorithm system. There is a highly significant association between the algorithm system score and estimated body fat percentage ($P < 0.0001$) (*A*). Association between estimated percentage of body fat, determined by DXA, and body condition score determined by the 9-point silhouette system (3) (*B*). Again, there is a highly significant association between body condition score determined by the 9-point silhouette and estimated body fat percentage ($P < 0.0001$). S represents the estimated standard deviation of the error in the model. R^2 represents the coefficient of determination indicating how much variation in the response is explained by the model; the higher the R^2, the better the model fits the data. Data was analyzed by simple linear regression.

7-point algorithm system. Therefore, more work is required to compare the performances of these 2 systems in more detail.

Correlation was good between experienced operators and scores were determined independently by the owners who had no prior experience of body condition scoring. Further, when scores disagreed, they only disagreed by 1 integer category of each other, and the discrepancies were mostly between categories 6/7 and 7/7. This is of particular note, given that the condition distinguishing these 2 scores was based on an assessment of the mobility and health of the animal, and it is likely that owners and clinicians would use different information to make such an assessment. To aid untrained operators in correctly distinguishing between these categories, it would be necessary to redesign this part of the chart and to use more objective criteria. However, it should be noted that errors between these 2 scores would not affect decision making (e.g., need for weight reduction). The fact that scores more commonly agreed than disagreed implies that the algorithm system would be suitable for obtaining large data sets on body composition from studies involving inexperienced operators (e.g., as in questionnaire-based surveys, or scoring at cat and dogs shows, etc.).

The current study has also demonstrated that the new algorithm system correlates well with body fat mass estimated by DXA. Results obtained using the 7-point algorithm system were equivalent to those of the commonly used 9-point silhouette system. Variability was seen within the range of body fat for each score, but the degree of variability was similar to that of the 9-point scoring system (2–4). This may be the result, in part, of scoring inaccuracy; although breed and gender difference likely have a profound effect, as demonstrated previously (10).

The main value of body condition scoring systems is that they help clinicians and owners determine the ideal body composition for their pets. Previous studies in companion animals have demonstrated increases in morbidity in patients with poor body condition (7,8), and increased morbidity and mortality risk in obese animals (11,12). However, more structured epidemiological studies are required to confirm whether the current body condition recommendations are optimal for all breeds, ages, and genders of dogs and cats. The new algorithm system is designed to help owners determine the body condition of their pets and thereby prevent, or promote the treatment of, obesity in their companion animals.

In summary, the body condition scoring system reported here correlates well with body composition, and agreement among experienced operators is excellent. Agreement exists among measurements performed by experienced operators and owners, which suggests that the method is reliable when used without prior training.

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LITERATURE CITED

1. Burkholder WJ. Use of body condition scores in clinical assessment of the provision of optimal nutrition. J Am Vet Med Assoc. 2000;217:650–3.
2. Laflamme D. Development and validation of a body condition score system for dogs. Canine Pract. 1997;22:10–5.
3. Laflamme D. Development and validation of a body condition score system for cats: a clinical tool. Feline Pract. 1997;25:13–8.
4. Mawby DI, Bartges JW, D'Avignon A, Laflamme DP, Moyers TD, Cottrell T. Comparison of various methods for estimating body fat in dogs. J Am Anim Hosp Assoc. 2004;40:109–14.
5. McGreevy PD, Thomson PC, Pride C, Fawcett A, Grassi T, Jones B. Prevalence of obesity in dogs examined by Australian veterinary practices and the risk factors involved. Vet Rec. 2005;156:695–702.
6. Lund EM, Armstrong PJ, Kirk CA, Kolar LM, Klausner JS. Health status and population characteristics of dogs and cats examined at private practices in the United States. J Am Vet Med Assoc. 1999;214:1336–41.
7. Scarlett JM, Donoghue S. Associations between body condition and disease in cats. J Am Vet Med Assoc. 1998;212:1725–31.
8. Doria-Rose VP, Scarlett JM. Mortality rates and causes of death among emaciated cats. J Am Vet Med Assoc. 2000;216:347–51.
9. Altman DG. Practical statistics for medical research. London: Chapman and Hall; 1991.
10. Lauten SD, Cox NR, Brawner WR, Baker HJ. Use of dual energy x-ray absorptiometry for noninvasive body composition measurements in clinically normal dogs. Am J Vet Res. 2001;62:1295–301.
11. Kealy RD, Lawler DF, Ballam JM, Mantz SL, Biery DN, Greeley EH, Lust G, Segre M, Smith GK, Stowe HD. Effects of diet restriction on life span and age-related changes in dogs. J Am Vet Med Assoc. 2002;220:1315–20.
12. Hess RS, Kass PH, Shofer FS, Van Winkle TJ, Washabau RJ. Evaluation of risk factors for fatal acute pancreatitis in dogs. J Am Vet Med Assoc. 1999;214:46–51.