Canine recommended breed weight ranges are not a good predictor of an ideal body condition score

Eleanor G. Smith [a], Katherine Davis [b], Laura Sulsh [b], Simon C. Harvey [a], Katie E. Fowler [a]

[a] *School of Human and Life Sciences, Canterbury Christ Church University, North Holmes Road, Canterbury, Kent, CT1 1QU.*
[b] *Portland Road Veterinary Surgery, 27 Portland Road, East Grinstead, West Sussex, RH19 4EB.*

* Corresponding author. Tel.: +44 1227 921820.
E-mail address: katie.fowler@canterbury.ac.uk (K. E. Fowler).

Abstract
Breed-specific ideal bodyweight range information is widely used by dog owners and breeders as a guideline to ensure animals are within a healthy weight range. Body Condition Scoring, a method used by veterinarians to assess an animal's overall shape irrespective of weight is considered to be an excellent method to determine an animals' overall body condition; these values however do not always correspond to published weight ranges. Here, the weight, neuter status, age and a 9-point Body Condition Score of a population of 140 purebred dogs was recorded and subsequently analysed to determine whether bodyweight was an effective predictor for Body Condition Scores. This comparison indicated that published recommended, breed-specific body weight ranges are not a good predictor for an ideal BCS and as such, guidelines for owners and breeders need to be systematically reviewed.

Keywords: Body Condition Score; Obesity; Dog; Breed; Weight

Canine obesity is common, with the incidence of overweight and obese dogs ranging from 23% to 41% of the population (Lund et al., 2006). Obesity causes disorders such as diabetes mellitus, cardiovascular and musculoskeletal disease, decreased immuno-competence, reduced lifespan, and may decrease quality of life (German et al., 2012). Canine obesity also has a significant economic cost to owners. As numerous factors influence dog weight including age, breed, gender and lifestyle (White et al., 2011), owner behaviour and understanding is key to controlling canine obesity.

The correct evaluation of a dog's body composition is essential for assessing a dog's weight status. Simply weighing a dog does not factor in variances in body composition; Body Condition Scoring (BCS) provides an evaluation of body fat percentage and is widely used in veterinary practices to date (German 2006; Laflamme et al., 1994 and Mawby et al., 2004). The most common method is a 9-point BCS that involves evaluation of visual and palpable features associated with subcutaneous fat, superficial musculature and abdominal fat (German 2006). A BCS classification that identifies an animal as thin, ideal or overweight potentially therefore usefully conveys to owners or breeders that they need to adjust their dogs' lifestyle or diet.

Here we have assessed weight range guides and body condition scores in 140 purebred dogs. Data were collected at the Portland Road Veterinary Surgery, East Grinstead between August 2016 and November 2016. Dog weight was recorded using calibrated veterinary scales, and each dog was assigned a BCS using the Royal Canin 9-integer BCS system (Royal Canin, 2015). Each animal was assessed by one of two veterinarians. Breed standard

information was obtained from the Purina dog breed standard database (Purina, 2017). The animals' age, breed, sex and neuter status were also recorded and the study protocol adhered to Canterbury Christ Church University's Ethics Review Checklist. The distribution of animals across breeds was highly variable, with eight breeds making up 80 of the animals tested. These common breeds were Labrador (24), Jack Russell Terrier (13), Cocker Spaniel (12), Springer Spaniel (9), Border Collie (7), Bulldog (5), Hungarian Vizsla (5) and Staffordshire Bull Terrier (5). The remaining 60 animals came from 33 other breeds, with 20 of these represented by only a single animal. Raw data can be found in supplementary material.

To account for differences between breeds, we calculated the percentage by which each animal differed from the midpoint of the breed weight range as follows: weight difference = (animal weight – breed weight range midpoint)/breed weight range midpoint) x 100. To assess the role of sex and neuter status on weight, we constructed a linear model of weight difference in R version 3.3.0 (R Core Team, 2016). Model simplification and comparisons between models by partial F-test indicated that the weight difference was affected by sex, neuter status and age ($F_{1, 136} = 17.99$, $p < 0.001$, $F_{1, 136} = 4.34$, $p = 0.039$, and $F_{1, 136} = 4.6$, $p = 0.033$, respectively), with males and neutered animals being heavier and animals increasing in weight with age. The normality of residual distribution of the final model was assessed using scatter and quantile-quantile plots. These analyses are in line with previous work; for instance, neutering is a risk factor for obesity (Jeusette et al., 2004, Lefebvre et al., 2013) and the occurrence of obesity in dogs rises with age due to a decrease in metabolic rate and activity (McGreevy et al., 2005).

Comparison of assessments of BCS with weight guidelines (Figure 1) indicate the recommended breed body weight ranges are not a good predictor for an ideal BCS. This was particularly true when dogs were below their recommended weight range as the majority of these animals (24/31) were still scored as having an ideal BCS and only 3 animals had a lower than ideal BCS. The recommended weight ranges appeared to be more successful in predicting overweight or obese BCS for dogs that were above the recommended range as 32 of the 74 animals that were above the weight range for their breed were also assessed with a higher than ideal BCS (Figure 1). This evidence suggests that published recommended weight ranges should only be used as a guide when assessing the weight status of a dog. Given the strong correlation between BCS and body fat mass as measured using dual-energy x-ray absorptiometry (Gant et al., 2016), this suggests that this method should be used when possible, however due to the nature of the process and the equipment needed, this may not always be feasible for most veterinary practices.

Given that previous studies suggest no correlation between BCS assessments made by experienced veterinarians or breeders, and those of owners, with the owners frequently underestimating their dog's score (Heuberger and Wakshlag 2011), the 9-integer BCS system may not be the best method. Eastland-Jones et al., (2014) found that even with the use of a BCS chart and guidance from an experienced scorer, dog owners still could not accurately assess their dog's overweight status (Eastland-Jones et al 2014). Other BCS methods include a modified 7-category algorithm-based protocol (German, et al., 2006). Interestingly, Witzel et al., 2014 have indicated that a 9-point scale has limitations in estimating adiposity past a BCS of 7; these findings are in concordance with the results of this study. It is also important to note that breed standard information is based on height at withers or length in some breeds. As many UK dog breeders will also aim for Kennel Club breed standards around conformation, such information could also be important. We cannot exclude the possibility that the dogs analysed here are small for their breed. However, as they are an unbiased sample of animals

presenting at a veterinary practice this merely strengthens the view that breed standard information is not appropriate for owners assessing an individual dog's weight status.

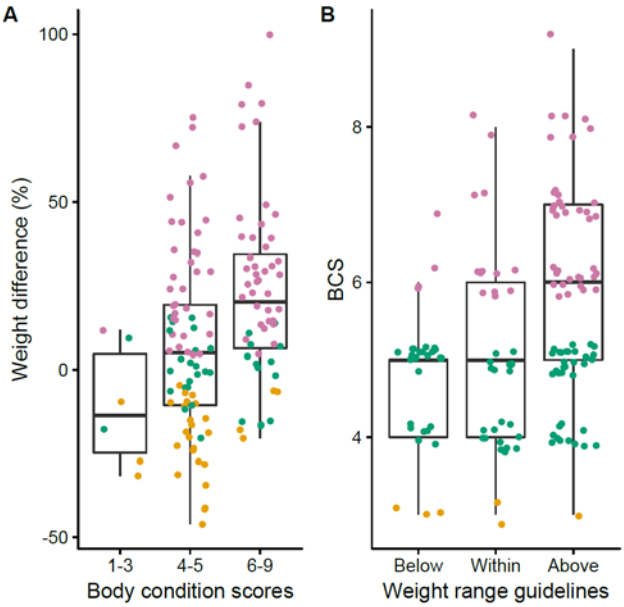

Figure 1: (A) Percentage weight difference (calculated by: animal weight – breed weight range midpoint)/breed weight range midpoint) x 100) for dogs assigned BCS's indicating they are too thin (BCS 1-3), ideal condition (BCS 4-5) or overweight/obese (BCS 6-9). Here, pink dots represent animals weighting more than the recommended weight range for their breed, green dots represent animals that are within the ideal weight range, and yellow dots represent animals weighting less than the recommended weight range. (B) BCS for dogs below, within and above the recommended weight range for their breed. Here, yellow dots represent animals that have been assigned a BCS of 3 or below (too thin), green dots represent animals assigned an BCS of 4 or 5 (ideal condition), and pink dots represent animals that have been classified as having a BCS of 6 or above (overweight/obese).

In summary, the current study provides preliminary evidence that recommended breed weight ranges should not be as a definitive method for assessing a dog's weight status and that, importantly, guidelines for owners and breeders should be systematically reviewed. This information could potentially be of use to veterinary practices and breeders when advising owners on how to monitor their animal's weight status. Further study is however required with a larger sample size, to investigate the outcome in a population that is more representative and also give the ability to look at specific breed outcomes.

References

Eastland-Jones R.C., German A.J., Holden S.L., Biourge V., Pickavance L.C. (2014). Owner misperception of canine body condition persists despite use of a body condition score chart. *Journal of Nutritional Science*, 3, 1-4. *doi*:10.1017/jns.2014.25

Gant, P., Holden, S. L., Biourge, V., & German, A. J. (2016). Can you estimate body composition in dogs from photographs? *BMC Veterinary Research*, 12, 1-12. *doi*: 10.1186/s12917-016-0642-7

German A.J. (2006). The Growing Problem of Obesity in Dogs and Cats. *Journal of Nutrition, American Society for Nutrition*, 136, 7, 1940S-1946S.

German A. J., Holden S.L. , Moxham G.L. , Holmes K.L., Hackett R.M., Rawlings J.M. (2006). A Simple, Reliable Tool for Owners to Assess the Body Condition of Their Dog or Cat. *The Journal of Nutrition*, 136, 2031S-2033S.

German A.J., Holden S.L., Wiseman-Orr M.L., Reid J., Nolan A.M., Biourge V., Morris P.J., Scott E.M. (2012). Quality of life is reduced in obese dogs but improves after successful weight loss, *The Veterinary Journal*, 192, 428-434. *doi*: :10.1016/j.tvjl.2011.09.015

Heuberger, R. and Wakshlag, J. (2011). The relationship of feeding patterns and obesity in dogs. *Journal of Animal Physiology and Animal Nutrition*, 95, 98–105. *doi*: 10.1016/j.tvjl.2011.09.015

Laflamme, D.P., Kealy, R.D. and Schmidt, D.A. (1994). Estimation of body fat by body condition score. *Journal of Veterinary Internal Medicine*, 8, 154

Lefebvre S.L., Yang M., Wang M., Elliott D.A., Buff P.R., Lund E.M. (2013). Effect of age at gonadectomy on the probability of dogs becoming overweight. *Journal of the American Veterinary Medical Association*, 243, 2, 236-243. *doi*: 10.2460/javma.243.2.236

Lund E.M, Armstrong J., Kirk C.A, Klausner J.S. (2006). Prevalence and Risk Factors for Obesity in Adult Dogs from Private US Veterinary Practices. *International Journal of Applied Research in Veterinary Medicine*, 4, No. 2, 177-186.

Mawby, D.I., Bartges, J.W., d'Avignon, A., Laflamme, D.P., Moyers, T.D. and Cottrell, T. (2004). Comparison of various methods for estimating body fat in dogs. *Journal of the American Animal Hospital Association*, 40, 109-114. *doi*: 10.5326/0400109

McGreevy P. D., Thomson P. C., Pride C., Fawcett A., Grassi T., Jones B. (2005). Prevalence of obesity in dogs examined by Australian veterinary practices and the risk factors involved. *The Veterinary Record*, 156, 695-702. *doi*: 10.1136/vr.156.22.695

Purina, (2017), Breed Library, available at: https://www.purina.co.uk/dogs/dog-breeds/dog-breed-library, Date accessed 30/03/2017

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Royal Canin, (2015), Weight Management Programme, Body Condition Score [pdf], pp. 1-6. http://www.royalcaninhealthyweight.co.uk/pet-obesity

White, G. A., Hobson-West, P., Cobb, K., Craigon, J., Hammond, R. and Millar, K. M. (2011). Canine obesity: is there a difference between veterinarian and owner perception? *Journal of Small Animal Practice*, 52, 622–626. *doi*: 10.1111/j.1748-5827.2011.01138.x

Witzel, A.L., Kirk, C.A., Henry, G.A., Toll, P.W., Brejda, J.J. and Paetau-Robinson, I. (2014). Use of a novel morphometric method and body fat index system for estimation of body composition in overweight and obese dogs. *Journal of the American Veterinary Medical Association*, 244, 1279-1284. *doi*: 10.2460/javma.244.11.1279