Best in show but not best shape: a photographic assessment of show dog body condition

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Running header Body condition of show dogs

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Abstract

Previous studies suggest that owners often wrongly perceive overweight dogs to be in normal condition. The body shape of dogs attending shows might influence owners' perceptions, with online images of overweight show winners having a negative effect. This was an observational *in silico* study of canine body condition. 14 obese-prone breeds and 14 matched non-obese-probe breeds were first selected, and one operator then used an online search engine to identify 40 images, per breed, of dogs that had appeared at a major national UK show (Crufts®). After images were anonymised and coded, a second observer subjectively assessed body condition, in a single sitting, using a previously validated method. Of 1120 photographs initially identified, 960 were suitable for assessing body condition, with all unsuitable images being from longhaired breeds. None of the dogs (0%) were underweight, 708 (74%) were in ideal condition, and 252 (26%) were overweight. Pugs, Basset Hounds, and Labrador Retrievers were most likely to be overweight, whilst Standard Poodles, Rhodesian Ridgebacks, Hungarian Vizslas, and Dobermanns were least likely to be overweight. Given the proportion of show dogs from some breeds that are overweight, breed standards should be redefined to be consistent with a dog in optimal body condition.

Keywords. Obesity, overweight, canine, pedigree dog, body composition

Introduction

Canine obesity is now a common medical disorder (German 2006) with recent UK studies suggesting that over half of all pet dogs are now overweight (Courcier and others 2010). The condition is linked to diseases such as orthopaedic disease, diabetes mellitus, respiratory disease, and certain types of neoplasia (Lund and others 2006; German and others 2010), as well as being a major welfare concern given adverse effects on quality of life (German and others 2012) and longevity (Kealy and others 2002). Despite this, veterinarians uncommonly raise the issue of obesity with their clients (German and Morgan 2008; Rolph and Others 2014) and, when they do, it is often met with distrust (White and others 2010). This owner reaction might be due to the fact that owners under-estimate the true body condition of their dog, thereby believing overweight dogs to be slimmer than they are (Courcier and others 2010; Eastland-Jones and others 2014). The basis of owner misperception of body condition is not known, and two possibilities exist. First, it might be that their perception of body shape is incorrect, as with obese humans who under-estimate their own body size (Wright and Whitehead 1987) and parents who misperceive the body shape of their children (Campbell and others 2006). Alternatively, owners' perception of body shape might reflect that of society as a whole, with the condition of overweight dogs assumed to be normal. If the latter, were true, then images of dogs in the media might influence owners' perception of optimal body shape.

Dog shows are the most popular form of canine competition, and receive widespread media interest. For instance, Crufts® is the UK's national dog show and is the

65 largest in the world, with 28,000 dogs participating each year, and 160,000
66 spectators (Crufts® 2014a). Show dogs are perceived to be the ideal specimens of
67 their breed, and images of dog show winners can be disseminated widely in the
68 media, especially over the Internet. Given that 75-80% of UK dogs are purebred
69 (O'Neill and others 2014), any deviation of the body condition of a show dogs from
70 ideal, has the potential to adversely influence the perception of many dog owners as
71 to what is normal. However, limited data currently exist on the body condition of
72 show dogs as portrayed in online images. Given the null hypothesis that all show
73 dogs would be in optimal condition, the main aim of the current study was to assess
74 the body condition of show dogs using images available online. Assuming that the
75 null hypothesis was rejected, a secondary aim was to determine factors associated
76 with overweight body condition.
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Materials and methods

Study protocol and overview

This was a cross-sectional, retrospective, *in silico*, study, conducted between February and May 2014 at the University of Liverpool School of Veterinary Science, and designed to assess the body condition of UK show dogs using online images. The study comprised 3 parts, discussed in further detail below. The first part consisted of image and data acquisition, and was conducted by one investigator (ZS). In the second part, another investigator (AJG), who was blinded to the dog details, subjectively assessed the body condition of dogs pictured in all of the images. Once the second part had been completed, the body condition results were matched to the dog-specific information to enable the second investigator to analyse the data (part 3).

Part one: image and data acquisition

Information Sources

Photographs from dogs that have appeared at a UK national dog show (Crufts®) were identified using the online search engine (Google Images 2014). Searches were conducted on a single computer, between 20 February 2014 and 10 March 2014. First, available results from the Crufts® dog show (Crufts® 2014b) were examined to identify names of dogs that had been placed at shows. Each name was used as a search term to identify pictures of that dog. If the results returned were not specific enough to identify suitable images, the search was refined, for instance by adding the name of the relevant breed.

Breed Selection

In order to ensure that a wide range of breeds was studied, a systematic searching protocol was used. First, a list of dog breeds prone to obesity was compiled, based upon previously published studies (German 2006; Lund and others 2006; Courcier and others 2010; Zoran 2010). Ultimately, 14 obese-prone breeds were identified, including breeds from all Kennel Club groups (The Kennel Club, 2014a) including Gundog (Labrador Retriever, Cocker Spaniel, Golden Retriever), Hound (Basset Hound, Beagle, Dachshund), Pastoral (Shetland Sheepdog), Terrier (Cairn Terrier, Scottish Terrier), Toy (Cavalier King Charles Spaniel, Pug), Utility (Dalmatian), and Working (Boxer, Rottweiler) groups. Each breed was paired with a breed from the same Kennel Club group that not reportedly prone to obesity. When possible, breeds were chosen that were similar to the obese-prone breed in terms of stature and body shape. The 14 non-obese prone breeds chosen comprised the following (listed in order of pairings with the obese-prone breeds above): Gundog group (Hungarian Vizsla, Springer Spaniel, Flat Coated Retriever), Hound group (Rhodesian Ridgeback, Basset Griffon Vendeen [Petit], Irish Wolfhound), Pastoral group (Welsh Corgi [Pembroke]), Terrier group (Border Terrier, West Highland White Terrier), Cairn Terrier, Scottish Terrier), Toy group (Chihuahua, Bichon Frise), Utility group (Poodle [Standard]), and Working group (Bullmastiff, Dobermann).

Eligibility of Dogs

In order for a dog to be eligible it must have placed between first and fifth in its class (e.g. Open, Limit, Mid Limit, Post Graduate, Graduate, Under Graduate or Veteran)

at a UK national dog show (Crufts®) between 2001 and 2013. Additionally, only adults were considered because the photographic condition scoring system used had not been validated for growing dogs.

Eligibility of Images

Images were only suitable if they were in focus, and had been taken from the side with the dog in a standing position (Laflamme 1997, German and others 2006). Furthermore, only one dog could be included in the picture in order to avoid confusion and possible bias through comparison between dogs. Finally, images were only used when the identity of the dog could be conclusively confirmed, based upon the details provided on the website where the image appeared.

Image acquisition and data recording

In order to ensure a range of images was assessed, a systematic approach was used for image acquisition. In this respect, suitable images of 5 male and 5 female dogs from each breed were selected, from each of 4 time categories (e.g. 2001-2008, 2009-2011, 2012, and 2013), making a total of 40 images per breed, and 1120 images in total. Each image was assigned a unique study code, and temporarily saved to an external hard drive (1 TB Seagate® Expansion™ External Drive, Seagate) in Joint Photographic Experts Group (JPEG) format. A computer spreadsheet (Excel 2007, Microsoft Corporation) was created to record accompanying data for each image, as follows: study code, year of competition, breed, Kennel Club group, whether or not from an obese-prone breed, sex, coat colour, and placing in the show. No dog- or owner-identifying information was recorded.

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154 **Part 2: Subjective assessment of body condition**

155 Body condition was subjectively assessed from the images collected, in a single
156 sitting, by a second investigator (AJG) with experience in assessing body condition
157 from photographs. The technique used was a validated semi-quantitative scoring
158 method using the visual descriptors used in conventional BCS systems (Laflamme
159 1997, German and others 2006), with dogs being assigned to one of three
160 categories: underweight (BCS 1-3/9), ideal condition (BCS 4-5/9), and overweight (6-
161 9/9). In previous validation work (Gant and others 2013), the same investigator
162 (AJG) assessed body condition using photographs from 105 dogs, and results
163 correlated strongly with body fat mass measured by dual-energy X-ray
164 absorptiometry (R_s 0.84, $P<0.001$). The same approach was adopted in the current
165 study, and all results were entered into a second computer spreadsheet (Excel
166 2007), identified by the unique study code only. Once all images had been
167 assessed, the hard drive was wiped so that there was no possibility of using the
168 images for any other purposes, or of subsequently identifying the dogs that had
169 participated in the study.

170

171 **Part 3: Data analysis**

172 After part 2 of the project was completed, the data from both spreadsheets were then
173 combined so as to match body condition results to the dog-specific information. A
174 sample size calculation was not performed; instead, the number of images selected
175 for each breed was arbitrarily determined so that the overall study size, was broadly
176 similar to that of a previous study assessing body condition in dogs at shows
177 (Corbee 2013).

For each body condition category, results are reported as absolute numbers of dogs and percentages. Computer software (Stats Direct version 2.6.2; Stats Direct Ltd.) was used for all statistical analyses, with the level of significance set at $P<0.05$ for two-sided analyses. Logistic regression was used to determine what variables were associated with overweight body condition. The outcome variable tested was body condition, whereby dogs scored as overweight were assigned a score of 1, and dogs in ideal weight assigned a score of 0. Variables tested included sex, breed, Kennel Club group, breed prone to obesity, coat colour, year of competition, and placing in the show. Sex was classified according to a binary variable, with male dogs scored as 1, and female dogs scored as 0 (i.e. the reference category). For each breed, a dummy variable was created, whereby dogs of that breed were scored as 1 and dogs not of the breed scored as 0. For breed group, dummy variables were created for all Kennel Club groups (i.e. Gundog, Hound, Pastoral, Terrier, Toy, Utility, and Working), and Gundog was arbitrarily chosen as the reference category. In a similar manner, dummy variables were created for coat colour (i.e. light colour [e.g. cream, fawn, grey, white, and yellow], mid-colour [e.g. grizzle, red, russet gold, and wheaten], mixed colour [where. a mix of light and dark colours was present e.g. grizzle and white, liver and white, orange and white, tan and white, tricolour,], and dark colour [e.g. blue, black, chocolate, black and tan etc]), with light colour arbitrarily chosen as the reference category. For year of competition, dummy variables were created for each time category (e.g. 2001-2008, 2009-2011, 2012, 2013), with 2001-2008 arbitrarily chosen as the reference category. Finally, dummy variables were created placing in each show (from 1^{st} to 5^{th}), with first place arbitrarily chosen as the reference category.

Initially, all variables listed above were tested separately with simple logistic regression. Multiple regression was then use to account for possible confounding amongst variables, with an initial model including all variables identified as $P<0.2$ on simple regression analysis. This model was then refined over multiple rounds using backwards-stepwise elimination, of the least significant variable at each round, and variables were only retained in the final model if they were significant in their own right ($P<0.05$), or when removal led to a significant effect (i.e. >10%) on the model. Goodness of fit of the final model was assessed by the Pearson Chi-square goodness of fit test. Logistic regression results are reported as odds ratios (OR), 95% confidence intervals (95%-CI), and the associated P-value.

Ethical and copyright considerations

Given the study design, there were both ethical and copyright considerations. Before the study commenced, the protocol was reviewed and approved by the University of Liverpool Research Ethics Committee (VREC185). As described above, a number of procedures were implemented to ensure anonymity for all dogs and owners. First, all images were anonymised (using a unique study code) before being used, and no dog- or owner-identifying information was recorded at any stage. Further, only one investigator performed the internet searches on a single computer and, as soon as all images had been acquired, the computer's internet search history was deleted. Moreover, only one copy of each image was saved to the external hard drive, and this was identified by a study code only. Finally, the investigator who assessed body condition, was unaware of any of the dogs' details, and the hard drive was wiped as soon as all images had been assessed.

Given that the images used were acquired from the internet, it was critical to comply with appropriate copyright laws (Intellectual Property Office 2014). In this respect, “non-commercial research” is a permissible act under copyright law, and permission is not required to copy or use images in these circumstances. The images were not used for any other purpose and were not stored for any longer than was necessary for the study. As a result of this, owners of websites were not contacted in advance to request permission to use images.

Results

Images and dogs

Of the 1120 individual images originally acquired, 960 proved to be suitable for assessing body condition. The 160 images that were unsuitable were all from breeds with long coats, including Bichon Frise, Scottish Terrier, West Highland White Terrier and Shetland Sheepdog breeds. In all cases, the long hair made it difficult to assess visual characteristics of condition reliably, such as abdominal tuck and whether ribs could be seen. Of the 960 dogs ultimately included, 0 (0%) were scored as underweight, 708 (74%) scored as ideal condition (n=708), and 252 (26%) as overweight. The number and percentages of dogs in the different body condition categories, stratified according to breed and other variables, are reported in Tables 1 and 2, respectively.

Simple logistic regression

Breed

On simple regression analysis (Table 1), overweight status was positively associated with three breeds (Bassett Hound, OR=6.42, 3.25-12.64, P<0.001; Labrador Retriever, OR=5.09, 2.64-9.82, P<0.001; Pug, OR=12.73, 5.78-28.03, P<0.001) and negatively associated with six breeds (Border Terrier, OR=6.42, 3.25-12.64, P<0.001; Boxer, OR=6.42, 3.25-12.64, P<0.001; Dobermann, OR=6.42, 3.25-12.64, P<0.001; Hungarian Vizsla OR=6.42, 3.25-12.64, P<0.001; Standard Poodle, OR=6.42, 3.25-12.64, P<0.001; and Rhodesian Ridgeback, OR=6.42, 3.25-12.64, P<0.001). Although springer spaniel (OR=0.48, 0.20-1.17, P=0.11) was not significantly associated with overweight condition, this breed qualified for inclusion in the initial multiple logistic regression model.

Other variables

With simple logistic regression, overweight condition was positively associated with dogs from the toy group (OR 1.92, 1.21-3.05, P=0.01), and negatively associated with dogs in the utility group (OR 0.30, 0.14-0.66, P=0.003). Further, dogs with a light coat colour were more likely to be overweight than all other coat colours (vs. light colour: mid coat colour, OR=0.25, 0.15-0.40, P<0.001; mid coat colour, OR=0.58, 0.40-0.83, P=0.004; dark coat colour, OR=0.59, 0.40-0.89, P=0.01; Table 2). However, there was no association between overweight status and either sex, placing in show, or time category, and no other variables qualified for inclusion in the initial multiple logistic regression model (Table 2).

Multiple conditional logistic regression

The initial multiple regression model comprised 13 variables: the dummy variables for 10 of the breeds (see above), and the three coat colour dummy variables (mid colour, mixed colour, and dark colour). The independent variables that remained in the final regression model were 9 of the breed dummy variables, and one coat colour variable, and this model was judged to be a good fit for the data (Table 3, P=0.66). Overweight status was positively associated with dogs that were Basset Hounds (OR=7.55, 3.63-15.67, P<0.001), Labrador Retrievers (OR=4.16, 2.11-8.21, P<0.001), or Pugs (OR=10.00, 4.46-22.41, P<0.001), and negatively associated with dogs that were Border terriers (OR=0.20, 0.06-0.67, P=0.01), Boxers (OR=0.27, 0.08-0.91, P=0.03), Dobermanns (OR=0.13, 0.03-0.56, P=0.01), Hungarian Vizslas (OR=0.13, 0.03-0.56, P=0.01), Rhodesian Ridgebacks (OR=0.13, 0.03-0.56,

286 P=0.01),Standard Poodles (OR=0.06, 0.01-0.47, P=0.01), or had a mixed coat colour

287 (OR=0.69, 0.047-1.00, P=0.05).

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Discussion

In the current study, we have assessed the body condition of show dogs using online images. Approximately 26% of the show dogs examined were overweight, which is less than recent reported prevalence of overweight dogs in the UK pet dog population (Courcier and others 2011). However, the findings are similar to results from a previous study that assessed the body condition of show dogs in the Netherlands, where 19% of dogs were overweight (Corbee 2013). Whilst this suggests that show dogs may be in better body condition than the pet population as a whole, the fact that approximately a quarter were above ideal weight is still a cause for concern. These dogs showcase the ideal characteristics of the pedigree breed, and there is a danger that widespread media exposure might adversely influence owner perception of optimal body shape. Whilst the three breeds with the greatest prevalence of overweight condition were from the obese-prone category, the prevalence of overweight condition was low in boxers, despite the fact that this breed was also in the obese-prone category. This suggests that not all obese-prone dogs are overweight at national shows. In light of this, breed-specific approaches might be most pertinent for addressing the issue for show dogs.

In a previous study regarding body condition of show dogs, prevalence of overweight status was greater in some breeds (Corbee 2013). Similar findings were noted in the current study, with overweight condition being highly prevalent in three breeds, but uncommon in six others. However, in the previous study, whilst many different breeds were included, only small numbers of dogs were assessed for many of the individual breeds, limiting the ability to judge prevalence within breed. Further, the

314 author assessed body condition only once, making it impossible to assess possible
315 changes in prevalence over time, and also did not consider a possible influence of
316 other factors such as placing within the show. Whilst the study was of a similar
317 magnitude, the use of Internet images in the current study enabled us to adopt a
318 systematic approach to case inclusion. Further, we increased the numbers of dogs
319 examined per breed by only assessing breeds prone to obesity, and matched control
320 breeds. Despite the systematic breed selection, the diversity of breeds selected was
321 wide, comprising a range of statures (from Miniature Dachshund to Irish Wolfhound),
322 breeds from all Kennel Club groups, and 10 of the 20 most popular UK Kennel Club
323 breeds by registration in 2013 (The Kennel Club 2014b). Further, by systematically
324 including images from a 13-year period, and recording data on placing in show, we
325 were able to whether any temporal changes in body condition had occurred in show
326 dogs, and to what extent body condition influenced placing in the show.
327
328 In light of adverse media publicity, much greater emphasis has recently been placed
329 on promoting good health in pedigree dogs, and discouraging exaggeration of
330 characteristics that may cause adverse health effects (Crispin 2011). There have
331 also been changes in policy regarding the criteria for judging dogs at shows, with the
332 aim of encouraging more responsible breeding and pet ownership. Indeed, in 2014,
333 the UK Kennel Club introduced its 'Breed Watch' scheme, designed to act as an
334 early warning system to increase awareness of possible health problems in specific
335 breeds (The Kennel Club 2014c). Further, judges are advised to ensure that only
336 dogs perceived to be healthy dogs win prizes, and are given breed-specific advice
337 on what characteristics that can produce adverse health effects. Indeed, overweight
338 body condition is included as a point of concern for many breeds. Disappointingly, in

the current study, we did not identify any difference in the prevalence of overweight condition based upon placing in the show, suggesting that being overweight does not reduce the likelihood of a dog winning. Further, there was no apparent evidence of a change in prevalence of overweight condition during the 13-year course of the study. This finding should be placed in the context of a rising overall prevalence of canine obesity in the UK pet population during this time (Edney and Smith 1986, Courcier and others 2010). Although this relative decrease in prevalence might be encouraging, it is disappointing that a quarter of show dogs remain overweight. Nonetheless, the findings regarding show placing and change in prevalence over time, cannot be taken as evidence that recent changes to guidance of show dog judges have not worked, because schemes such as the Kennel Club's Breed Watch, was introduced in 2014 (The Kennel Club 2014c), after the period used for the current study.

The Pug was originally bred to be a companion dog (The Kennel Club 2014a) and, as a consequence, no physiological advantage would be expected from an overweight body condition. Although the current standard is for a 'square and cobby' shape, the recommendation is that this be the result of muscle mass rather than fat (The Kennel Club 2014a). The results of the current study indicated that 80% of Pugs from shows were overweight, which is similar to the 71% overweight prevalence reported in Pugs from a population of pet dogs (Mao and others 2013), and consistent with body condition scores reported in a recent investigation at a dog show (Corbee 2013). The Pug is a high profile breed for health problems (The Kennel Club 2014c), and the high prevalence of overweight dogs highlights the need for urgent action to address this within the breed. Not surprisingly, therefore, the UK

Kennel Club has placed the Pug in category 3 (points of concern for health) in the 'Breed Watch' health-monitoring programme, and "significantly overweight is a point of concern for special attention by show judges.

Overweight condition was also prominent in Basset Hounds and Labrador retrievers where 68% and 63%, respectively, of show dogs were overweight. Since Bassett Hounds were traditionally bred for endurance and hunting, and Labrador retrievers were bred for field work (The Kennel Club 2014a), any increase in body weight could be disadvantageous to function. The Kennel Club's breed standard for Bassett Hounds suggests that dogs of the breed should be of 'considerable substance', but no guidance is given on the desired body composition (The Kennel Club 2014a). Therefore, it is possible that breeders with Bassett Hounds of smaller stature might attempt to increase 'substance' by increasing body fat mass. For Labrador retrievers, the breed is expected to be agile, and without excess body fat. The chest is expected to be 'of good width and depth', and this might increase the potential for owners of show dogs to aim for a heavier set dog. Whilst, the standard states that the effect not be produced by carrying excess weight, the inability of dog owners to judge body condition accurately (The Kennel Club 2014a), may make it difficult to avoid. As with the Pug, the Bassett Hound is a high profile breed (The Kennel Club 2014c), and judges are required to monitor overweight status amongst other issues. In contrast, Labrador retrievers are in the second most severe category of the national breed watch list, though show judges have been asked to be alert for significantly overweight examples (The Kennel Club 2014c).

In contrast to the fact that over a quarter of dogs were overweight, none were underweight, and perhaps suggests whilst that owners, breeders, and judges are more aware of the characteristics associated with underweight condition than of overweight condition. Indeed, whilst owners of underweight dogs do tend to over-estimate the condition of their dog, the effect is less marked than the tendency for owners of overweight dogs to under-estimate condition (Eastland-Jones and others 2014). Clearly, therefore, more effort is required to educate owners, breeders, and show judges so that they can all better recognise overweight condition.

Simple regression analysis revealed that a light coat colour was associated with overweight condition but, as was the case for the obese-prone breed category, the effect was not significant in the final multiple regression. Thus, rather than coat colour affecting the perception of body shape, individual breed effects likely explain the effect. Indeed, many dogs from obese-prone breeds had a light coat colour, for example 50% of Labrador retrievers, and 95% of the pugs were fawn; further, many non-obese-prone breeds had other coat colours such as Hungarian Vizslas and Rhodesian Ridgebacks which were both in the mid-colour range.

As with any study, there are limitations that should be considered when interpreting the results. Most importantly, whilst photographic assessment of body condition correlates well with body fat mass measured by DEXA, it does not perform as well as conventional body condition score assessment (Gant and others 2013). Thus, there may have been errors in the assessments for some of the dogs. Most notable was the fact that it was not possible to assess the body condition of some longhaired breeds and, consequently, these were removed from the analysis. To minimise the

errors of the method, we ensured that a single observer, with experience in using a validated photographic body condition score method, assessed all dogs in a single sitting. Therefore, it would be advisable to conduct further studies, using different methods of assessing body condition, and including with more dogs.

A second limitation was that selection of obese-prone breeds was based upon a number of recent and historical studies, including those from other studies. The breeds identified in these studies might not have been representative of the UK dog population. Third, whilst every effort was made to match breeds not prone to obesity with the chosen obese-prone breeds, this was not always possible. Most challenging was finding matches within the hound group; for instance, Dachshund and Beagles were paired with Rhodesian Ridgeback and Irish Wolfhound, respectively, even though stature was not well matched. Such a matching was not perfect, but arose because it was not possible to identify breeds of an equivalent stature, with sufficient images available for review. Despite this limitation the diversity of breeds was wide, and it is unclear to what extent the results were affected. A fourth limitation was the fact that, given the systematic method of selection, not all breeds were examined. Therefore, whilst the issue of overweight condition has been highlighted in certain breeds, similar issues might have been missed for breeds with unexpected problems. Further investigations would help to confirm the current findings, by enabling more dogs in more breeds to be assessed.

Conclusion

This study has shown that a significant proportion of show dogs from some breeds, such as Pugs, Basset Hounds and Labrador Retrievers are overweight. Although overweight condition in show dogs in less prevalent than in the general pet population, these findings are still concerning given the widespread potential for dissemination of images through the media. Further effort is now required to educate owners, breeders, and show judges so that they can all better recognise overweight condition, thus helping to prevent the development of obesity.

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Conflicts of Interest

The following conflicts of interest apply: AJG's academic post at the University of Liverpool is funded by Royal Canin. Mars Petcare also provides research funding for the author's weight management referral clinic at the University of Liverpool.

Author contributions

The contribution made by each author is as follows: ZS – collated relevant clinical data, analysed results, reviewed manuscript. AJG – designed study, collected clinical data, analysed results, drafted paper. Both authors have approved the final article.

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