

Institution: University of Liverpool		
Unit of Assessment: UoA6		
Title of case study: Improving recognition, management and prevention of obesity in dogs and cats		
Period when the underpinning research was undertaken: 2007 forwards		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Alexander J German	Role(s) (e.g. job title): Professor of Small Animal Medicine	Period(s) employed by submitting HEI: 2002 to present
Period when the claimed impact occurred: 2013 to 2020.		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact Overweight and obesity affect approximately half of adult dogs and cats worldwide, causing negative effects on health and welfare. University of Liverpool (UoL) research with collaborators has changed how veterinarians manage animal (cat and dog) obesity through the development of novel patented therapeutic weight loss diets, and evidence-based weight management protocols, which together improve clinical outcomes. Weight loss using these interventions averages 11% over 3 months with less risk of regain, improved mobility and improved quality of life. It is estimated that the health and wellbeing of approximately [text removed for publication] animals worldwide has been improved because of this UoL research.		
2. Underpinning research a. Novel patented therapeutic weight loss diets German at UoL (2002-present) and collaborators at Royal Canin, France, developed novel therapeutic diets for weight loss in animals (dogs and cats) with obesity, high in both protein and fibre, and containing psyllium husk as a fibre source. Superiority over existing commercial diets from the same manufacturer and competitors was demonstrated by research on this diet's physiological and clinical performance in colony dogs [3.1]. Despite being equally or more palatable, dogs voluntarily consumed 51% and 47% less of the novel diet than other diets with either high protein or high fibre content, respectively. These UoL experiments identified an optimal formulation with protein (minimum 30%), crude fibre (minimum 17.5%) and psyllium as the fibre source (at 0.5% w/w), which defined the point of novelty for successful patent specifications, protecting Royal Canin's "<i>Satiety Diet</i>" product range across various territories. Formulations with equivalent efficacy were also developed in cats. Clinical studies demonstrated the superiority of <i>Satiety diet</i> in clinical cases, with faster weight loss (1.0%/week vs. 0.7%/week) and greater fat mass loss (-58% vs. 37%) compared with an existing therapeutic diet [3.2]. Other work demonstrated that feeding <i>Satiety diet</i> after weight loss dramatically decreased odds of weight regain (OR 0.05, 95%CI 0.01-0.29), thus defining new recommendations for post-weight-loss maintenance [3.3]. b. Evidence-based weight management protocols In 2005, German also established the world's first specialist weight management clinic (UoL WMC) to undertake pioneering clinical research into companion animal obesity. This facility has enabled interrogation of different weight management protocols in cats and dogs with obesity. Efficacy of treatment approaches was previously under-researched. The characteristics and outcomes of approximately [text removed for publication] cats and dogs attending have now been captured, and 36 publications generated from studies on this cohort. For example, UoL WMC research has defined characteristics associated with successful weight loss in dogs and cats with obesity, highlighted the potential for failure (39% of dogs, 55% of cats) and identified factors associated with it [3.4]. These insights have been used to develop a suite of evidence-based animal (dog and cat) weight management protocols including calculations for energy intake to induce safe weight loss, establishing appropriate targets, tailoring the protocol to the individual,		

monitoring recommendations (e.g., frequency of weight rechecks, dietary adjustments over time), and prevention of regain.

c. Evidence of efficacy in dogs and cats with obesity

UoL confirmed the combined efficacy of the *novel patented therapeutic weight loss diets* and *evidence-based weight management protocols*, for example, improved quality of life [QOL] through weight loss, with the degree or improvement associated with the amount of adipose tissue lost [3.5]. Efficacy was also confirmed in the *largest ever international multi-centre weight loss studies* involving 926 dogs and 730 cats, from 340 veterinary practices across 27 countries [3.6]. There was substantial average weight loss (11.4% in dogs; 10.6% in cats) over the 12-week study period, and improvements in secondary outcomes such as activity (31% inactive before, 5% inactive after, $P<0.001$) and QOL (17% poor QOL before, 2% poor QOL after, $P<0.001$) demonstrating improved animal welfare [3.6].

3. References to the research

- 3.1 Weber M, Bissot T, Servet E, Sergheraert R, Biourge V, **German AJ** (2007) A high protein, high fiber diet designed for weight loss improves satiety in dogs. *Journal of Veterinary Internal Medicine* 21;1203-1208. DOI: 10.1111/j.1939-1676.2007.tb01939.x. Citations 98; Altmetric Attention Score n/a.
- 3.2 **German AJ**, Holden SL, Bissot T, Morris PJ, Biourge V (2010) A high protein high fibre diet improves weight loss in obese dogs. *The Veterinary Journal* 183, 294-297. DOI: 10.1016/j.tvjl.2008.12.004. Citations 78; Altmetric Attention Score 264.
- 3.3 **German AJ**, Holden SL, Morris PJ, Biourge V (2012) Long-term follow-up after weight management in obese dogs: The role of diet in preventing regain. *Veterinary Journal* 192, 65-70. Doi: 10.1016/j.tvjl.2011.04.001. Citations 57; Altmetric Attention Score 1.
- 3.4 **German AJ**, Titcomb JM, Holden SL, Queau Y, Morris PJ, Biourge V (2015) Cohort study of the success of controlled weight loss programs for obese dogs. *Journal of Veterinary Internal Medicine* 29, 1547-1555. Citations 22; Altmetric Attention Score 2
- 3.5 **German AJ**, Holden SL, Wiseman-Orr ML, Reid J, Nolan,AM. Biourge V, Morris,PJ, Scott EM (2012) Quality of life is reduced in obese dogs but improves after successful weight loss. *Veterinary Journal* 192, 428-434. Doi: 10.1016/j.tvjl.2011.09.015. Citations 104; Altmetric Attention Score 264.
- 3.6 Flanagan J, Bissot T, Hours M-A, Moreno B, Feugier A, **German AJ** (2017) Success of a weight loss plan for overweight dogs: The results of an international weight loss study. *PLoS ONE* 12 (9): e0184199. doi: 10.1371/journal.pone.0184199. Citations 15; Altmetric Attention Score 253.

4. Details of the impact

Obesity is a prevalent animal (dog and cat) disease, associated with many comorbidities, such as shortened lifespan, and poorer QOL [5.1]. Besides the welfare issues, the financial burden of obesity-related disease was estimated using 2009 data {USD05-2017} to be USD1,804/dog/year and USD1,049/cat/year; adjusting these figures for inflation (using a 12.3% inflation rate) would be equivalent to approximately USD2,026/dog/year and USD1,178/cat/year today [5.2]. This financial burden is corroborated by data from MORE TH>N Insurance, where obesity was a significant factor in approximately 50% of claims ([5.2]); this one UK insurance company paid out >GBP8,000,000 on 9,203 claims for obesity-related illnesses in 2018, with the average cost of a claim being 20% more from pets with obesity (GBP900/claim vs. GBP722/claim [5.2]). UoL has addressed this by changing veterinary practice in the clinical management of canine and feline obesity, as evidenced by (a) *global veterinary use of novel patented therapeutic weight loss diets* and (b) *adoption of evidence-based weight management protocols by veterinary professionals*. As a result, there is evidence of (c) *improved health and wellbeing of dogs and cats with obesity*.

a. Global veterinary use of novel patented therapeutic weight loss diets

UoL demonstrated the effective physiological and clinical performance of a novel therapeutic weight loss diet (combining high protein and fibre, with 0.5% w/w psyllium) that defined the point of novelty for successful patent applications protecting Royal Canin's *Satiety Diet* product range [5.3, 5.4]. This enabled marketing as a 'therapeutic diet' for the management of obesity, with such diets only being sold by veterinarians. Evidence of efficacy [3.1-3.6] supports the promotion of these diets globally

through on-package claims, information in product books and educational materials for veterinary professionals [5.4,5.5]. *Satiety Diet* has replaced Royal Canin's previous formulation (*Obesity Diet*) worldwide (Fig 1) [5.4, 5.6] and, as a result, Royal Canin therapeutic weight loss diets now outperform sales of competitor diets in most global markets (Fig 2: example: Canada) [5.6]. Independent market research confirms Mars Petcare (including Royal Canin) as the leading player in the global pet obesity market, exceeding the combined share of the next 3 largest companies [5.7].

[graphs removed for publication]

b. Adoption of evidence-based weight management protocols by veterinary professionals

(i) Educating veterinary professionals about obesity and tailored weight management protocols

Educational materials developed for veterinary professionals, based on evidence-based protocols designed at the UoL WMC, have trained veterinary professionals in running successful weight management programmes, including the concept of **tailoring the plan to the individual dog or cat** [5.1]. Worldwide, face-to-face training (over [text removed for publication] training sessions from UoL staff in 34 countries to approximately [text removed for publication] people) and online training packages (e.g., Royal Canin UK's *Weight Management Online*, a suite of 6 online training modules, approximately [text removed for publication] people trained in 2017) have been implemented [5.6]. Following the face-to-face training of veterinary professionals in Canadian practices, *Satiety diet* use increased by [text removed for publication] [5.6], whilst *Satiety diet* use increased by [text removed for publication] in practices whose staff completed *Weight Management Online* modules [5.6].

(ii) Electronic tools enabling veterinary professionals to implement weight management regimens

UoL-WMC-defined dietary energy requirements for successful weight loss, and recommendations on monitoring weight management regimens (e.g., timing of rechecks and dietary adjustments) [3.3-3.6] has enabled the development of veterinary weight management software to assist veterinary professionals with running tailored weight management programmes (e.g. calculating daily food intakes, graphically monitoring weight loss, adjusting plans according to response, and preventing regain). *Slim Fit* is a bespoke Canadian package used by approximately [text removed for publication] practices per annum, whilst the *Vet Follow-Up* online platform is used globally [text removed for publication] countries) by approximately [text removed for publication] veterinary practices per annum. Use of this software is associated with increased use of weight management regimens by veterinarians. For example, in [text removed for publication] [5.6]:

Slimfit Use	No. practices	Total sales of Satiety (\$)	AVG sales per clinic	Sales growth
[text removed for publication]				

Evidence of a clinical benefit is demonstrated in available data from the *Vet Follow-Up* online platform: examining data from [text removed for publication] dogs and cats with obesity from [text removed for publication] veterinary clinics across [text removed for publication] countries managed with the software, average weight loss was [text removed for publication] [5.8].

(iii) Policy changes addressing pet obesity and raised public awareness

German co-authored the position statements for veterinary professional bodies the *Global Pet Obesity Initiative (GPOI)* calling for the formal definition of obesity as a disease and for the *British Small Animal Veterinary Association (BSAVA)* providing guidance on treating cats and dogs with obesity [5.9]. The former is endorsed by 24 national and international veterinary associations and cites 13 UoL references, whilst the latter provides guidance to UK veterinary professionals and cites 18 UoL references. Raising awareness of pet obesity within the pet-owning public is also critical to ensure uptake of the interventions. Advice from UoL WMC has featured heavily in

global media, including 5 television documentaries (combining viewing total approximately 6,830,000 viewers) [5.10].

c. Improved health and wellbeing of dogs and cats with obesity

The adoption of **novel patented therapeutic weight loss diets** and **evidence-based weight management protocols** has led to successful weight loss in dogs and cats with obesity, as evidenced by published studies [3.3-3.6], client testimonials (154/185 [83%] 5* reviews; 171/185 [92%] 4* or 5* reviews [5.5]) and data gathered from the *Vet Follow-Up* online platform [5.8]. The impact of obesity comorbidities is also seen in clinical studies that have demonstrated improved mobility, respiratory function, renal function, insulin sensitivity and the reversal of other metabolic derangements [5.1, 5.5], all of which lead to better QOL [3.5,3.6]. *Satiety diet* is now used in [text removed for publication] countries across [text removed for publication] continents [5.4] for approximately [text removed for publication] animals (cats and dogs) per annum, and approximately [text removed for publication] [5.6]. Consequently, veterinarians and pet owners have been given the tools to enable successful weight loss in animals greatly improving the welfare of pet dogs and cats with obesity, globally.

5. Sources to corroborate the impact

- 5.1** German, A.J. (2016) Weight management in obese pets: the tailoring concept and how it can improve results. *Acta Veterinaria Scandinavica* **58**(Suppl 1), 57. Doi: 10.1186/s13028-016-0238-z. *This review article discusses improvements seen with successful weight loss in dogs and cats (PDF page 4) and how the weight management regimen can be tailored to maximise success, whilst preventing regain (PDF pages 6-7).*
- 5.2** **Evidence about the cost of pet obesity.** *The evidence in this PDF includes a published paper* (Bomberg, doi: 10.1016/j.jcpa.2017.03.007; **PDF pages 4-6**) *and a MORE TH>N Insurance press release (PDF page 20-21; <https://www.rsagroup.com/media/3647/rsa-more-than-pitpat-press-release-05112019.pdf>) that support statements about the financial impact of pet obesity.*
- 5.3** **Suite of patents underpinning the novel aspect of Satiety diet** in various markets including: **Europe** (PCT/EP2007/057501; filed: 20/7/07, granted: 27/3/13' **PDF page 3**), **Brazil** (PI 0713849-0 B1; filed: 20/07/2007, granted: 27/07/2051; **PDF page 12**), **China** (CN 101489413 B; filed: 20/7/07, granted: 09/01/2009; **PDF page 25**), **France** (FR 2 903 860 B1; filed: 21/07/20067, granted: 31/12 2010; **PDF page 33**), **Korea** (KR 10-13937 16; filed: 20/07/2007, granted: 16/03/2012; **PDF page 45**) and **Russia** (RU 2459 525 C2; filed: 20/7/07, granted: 20/08/2012; **PDF page 53**).
- 5.4** **Royal Canin (RC) letters of support** from [text removed for publication]
- 5.5** **Royal Canin research claims and client testimonials.** The evidence provided includes of on-package claims and their links to underpinning UoL research [refs 3.1-3.6] (**PDF pages 4-19**), references to UoL research in product books (**PDF pages 30, 32 and 47**), educational materials for vets (**PDF pages 65, 72, 85, 89-90, 93, 102 and 107-108**). Client testimonials are also provided (**PDF pages 115-125**).
- 5.6** **Royal Canin datasets.** Datasets provided by Royal Canin, [text removed for publication]
- 5.7** **Verified Market Research report.** Independent market research report of the global pet obesity market, including foods and other products. Both a company analysis (**PDF page 66**) and a market share analysis (**PDF page 85**) are provided, *supporting statement about Royal Canin being the leading player in the pet obesity market.*
- 5.8** **Royal Canin Vet Follow-Up online platform.** Details of this online weight management software package (<https://www.vet-followup.royalcanin.co.uk/user/login>; accessed 20.17 23/10/20), [text removed for publication]

- 5.9 Position statements and policies about obesity in dogs and cats.** Position statements of the GPOI <https://petobesityprevention.org/about/#GPOI> (accessed 13:27 17 July 2020; **PDF pages 4-7**) and BSAVA <https://www.bsava.com/Resources/Veterinary-resources/Position-statements/Obesity> (accessed 17:29 24/10/20; **PDF page 12**).
- 5.10 TV viewing figures and media items.** Viewing figures for television documentaries featuring the UoL WMC since 2013 including *Ben Fogle's Animal Hospital* (Channel 5, 2013-14; **PDF page 5**), *Dogs: Their Secret Lives* (Channel 4, 2014; **PDF pages 7-10**), and *Trust Me, I'm a Vet* (BBC2, 2017; **PDF pages 12-14**). Selected media items are also included (**PDF pages 16-26**).