

The prevalence and risk factors for overweight and obesity in the Dutch domestic cat population

Bussing, V.J.

DEPARTMENT OF SMALL ANIMAL SCIENCES, UTRECHT UNIVERSITY

08-07-2016

Abstract

A cross-sectional study design was used to determine the prevalence of overweight and obesity in the Dutch domestic cat population and to identify the risk factors for overweight and obesity in this population. Also, the owners' ability to define their cat's body condition score with the aid of a visual nine-point scale body condition score (BCS) chart was determined. Possible risk factors for overweight and obesity assessed in this study include age, gender, neuter status, diet, feeding regimen, housing and the owners' perception of the body condition score. Owners who presented their cat to feline friendly first opinion veterinary practices throughout the Netherlands filled out a questionnaire regarding these risk factors and assessed their cat's body condition score using a validated visual nine-point scale body condition score chart. The researcher determined the cat's body condition score using the same nine-point visual scale. Data were obtained from 77 cats. The combined overweight and obesity prevalence was 33.8% (n = 26). There was a fair agreement between the body condition score given by the owner and the researcher. Of the owners 39.0% (n = 30) assigned their cat the correct BCS. The only significant risk factor associated with overweight and obesity in this study was the owners' perception of the body condition score.

Introduction

As in human medicine, overweight and obesity are common problems in animal medicine. Weight problems are often seen in companion animals such as cats(1-4). Weight problems, especially obesity and overweight, are the most common found forms of malnutrition in feline medicine(2,5). Both overweight and obesity are the result of a positive energy balance over a longer period of time. This means that the energy intake of the cat is higher than the energy expenditure(6,7). Either increased food intake, increased efficiency in nutrient metabolism, decreased activity level, decreased metabolic rate or combinations of the before can lead to this positive energy balance(7). The existence of a prolonged positive energy balance leads to the formation of excessive adipose tissue

and has adverse effects on morbidity and mortality(6,8,9). Multiple diseases, such as diabetes mellitus, hepatic lipidosis, osteoarthritis, lameness and non-allergic skin conditions, are linked to being overweight or obese in feline medicine(1,2,5,6,10,11). Therefore it is important to identify the risk factors associated with feline overweight and obesity and the prevalence in the population.

There are many methods of weight classification in cats. Two of these methods are used widely in feline medicine. The first is to compare the cat's bodyweight to the cat's ideal bodyweight. An animal is said to be overweight when the animal's bodyweight exceeds its ideal bodyweight by 10-12%. Animals with a bodyweight exceeding the ideal bodyweight by more than 20% are said to be obese(8). The second method is the use of the

body condition score (BCS). This is a visual scale, normally consisting of either five or nine points, where one is said to be cachectic and five or nine severely obese(6,11-14). In the nine-point scale a one unit increase in body condition score above the ideal score of five is approximately equal to a 10% to 15% increase in bodyweight(6). A cat with a BCS of 6 is thus 10% to 15% above its ideal weight and classified as overweight, where a cat with a BCS of 8 is 30% to 45% heavier than its ideal bodyweight and classified as obese(6,14).

Previous studies have shown signs of an increasing incidence of overweight and obesity in cats over the past few years(1,6). The prevalence of overweight and obesity in feline is now said to be somewhere between 11.5% and 52%. There are major differences in prevalence between the different studies and countries(2-5,11-13,15). The most common found risk factors for feline overweight and obesity found in earlier studies are male gender, neutering, age, a diet consisting of premium or therapeutic food, insufficient feeding regimen, inactivity, which is mostly linked to being kept indoors, and owner underestimation of the cats weight and BCS(2,3,5-7,11-13,16-18).

This study has three main aims. The first aim is to assess the prevalence of overweight and obesity in the Dutch feline population. The second objective is to determine the owners ability to define their cats BCS using a visual nine point scale BCS chart. The final aim is to identify basic risk factors for overweight and obesity Dutch cats. Factors assessed in this study include age, gender, neuter status, diet, feeding regimen, housing and the owners perception of the BCS.

Material and method

Data of a group of 77 cats was collected at various veterinary practices in the

Netherlands. These practices were selected based on being either gold, silver or bronze level cat friendly practices according to the guidelines of the International Society of Feline Medicine. All cats participating in this experiment had to be over one year old. Owners were asked if their cat could participate in this study upon arrival at the veterinary practice. The owner was asked to fill out a questionnaire for each cat presented. This questionnaire consisted of questions about the demographics of the cat, feeding regimen, lifestyle and BCS. To help the owner determine the BCS of his or her cat a visual nine-point BCS chart was given to the owner. The questionnaire as shown in table 1 was based on the study of Courcier et al. and a study of Russell et al.(2,13). After completing the questionnaire, the body condition of each cat was assessed by the researcher, who was trained to do so at the Faculty of Veterinary Medicine of the Utrecht University in the Netherlands. A nine-point BCS system as previously described by Laflamme et al. was used to assess and classify the BCS of the cat(6).

Information gained by the questionnaire and the BCS assessment was entered in Excel (Microsoft 2010). The data on food brand were further specified using groups. These groups are cheap, popular, premium and therapeutic. The cheap brands are supermarket home brands. Popular brands are brands such as Felix, Gourmet and Whiskas and are sold at grocery stores, large-format pet retailers and farm store. Premium brands are sold at more exclusive pet stores and veterinary practices. Examples of premium brands are Royal Canin, Hills science plan and Trovet.

Table 1: Questionnaire for the cat owners. Based on a study by Courcier et al and a study by Russell et al(2,13).

Questionnaire

General questions

1. Age: _____ year(s)
2. Breed
 - Cross breed
 - Pure breed
3. If cross-breed which breeds? _____
4. If pure breed which breed? _____
5. Gender
 - Male
 - Female
6. Neutered status
 - Neutered
 - Entire
7. Does your cat have any medical condition(s) that might influence their weight, as far as you know?
 - Yes, _____
 - No

Questions regarding diet and feeding regimen

8. What is the main diet of your cat? (consisting 50% or more of the diet)
 - Canned food
 - Dry food
 - Both mixed equally 50:50
9. What is the brand of this food? _____
10. How often do you feed your cat?
 - Once a day
 - Twice a day
 - Trice a day
 - Ad libitum, bowl is always full
11. How often do you feed your cat snack, like milk or treats?
 - Every day
 - At least once a week, but not every day
 - At least once a month, but not every week
 - Never
12. How often do you feed your cat table scraps?
 - Every day
 - At least once a week but not every day
 - At least once a month but not every week
 - Never
13. How do you decide how much you feed your cat?
 - Instructions on the pack or can
 - Advice from the vet
 - Feed until the cat stops eating
 - Asses body condition and adjust
 - Always fed my cats this way
 - Based on intuition

Questions regarding housing

14. Is your cat able to go outside?
 - Yes
 - No
15. If yes can the cat roam free or is it kept in an enclosed area (like a balcony or backyard)
 - Roam free
 - Enclosed area

Body condition score

16. Using the body condition score chart, which body condition score would you assign to your cat?

Table 2: Demographics of the research group and the percentage of combined overweight and obesity within each risk factor group.

Characeristic	No.	%	No. overweight or obese	% overweight or obese
<i>Gender</i>				
Female	42	54,5	12	28,6
Male	35	45,4	14	40,0
<i>Neutered</i>				
Yes	72	93,5	25	34,7
No	5	6,5	1	20,0
<i>Breed</i>				
European shorthair	48	62,3	18	37,5
Other cross-bred	4	5,2	0	0
British shorthair	5	6,5	4	80,0
Main coon	4	5,2	0	0
Persian	4	5,2	1	25,0
Other pure-bred	12	15,6	3	25,0
<i>Breed</i>				
Cross-bred	52	67,5	18	34,6
Pure-bred	25	32,5	8	32,0
<i>Age (years)</i>				
≤2	12	15,6	3	25,0
3 to 5	25	32,4	13	52,0
6 to 8	12	15,6	3	25,0
9 to 11	12	15,6	4	33,0
12 to 14	11	14,3	3	27,3
≥15	5	6,5	0	0
<i>Health problems</i>				
Yes	9	11,7	1	11,1
No	68	88,3	25	36,7
<i>Main diet</i>				
Canned	5	6,5	0	0
Dry	57	74,0	21	36,9
Canned and dry 50:50	15	19,5	5	33,3
<i>Food brand</i>				
Populair	30	39,0	12	40,0
Premium	26	33,8	9	34,6
Therapeutic	11	14,3	4	36,4
Cheap	10	13,0	1	10,0

Table 2: Continued

Characeristic	No.	%	No. overweight or obese	% overweight or obese
<i>Feeding frequency</i>				
Once a day	6	7,8	2	33,3
Twice a day	28	36,4	9	32,1
Trice a day	7	9,1	3	42,3
Ad libitum	36	46,8	12	33,3
<i>Treats frequency</i>				
Every day	33	42,9	10	30,3
At least once a week	18	23,4	8	44,4
At least once a month	10	13,0	4	40,0
Never	16	20,8	4	25,0
<i>Table scraps frequency</i>				
Every day	2	2,6	1	50,0
At least once a week	1	1,3	0	0
At least once a month	4	5,2	0	0
Never	70	90,9	25	35,7
<i>Amount fed based on</i>				
Instructions on the food	12	15,6	4	33,3
Veterinarian advice	4	5,2	2	50,0
Based on BCS	16	9,1	7	43,8
Till the cat stops eating	7	20,8	1	14,3
Always done it this way	5	6,5	0	0
Based on intuition	33	42,9	12	36,4
<i>Outside</i>				
Yes	59	76,6	20	33,9
No	18	23,4	6	33,3
<i>Roaming free (if able to go outside)</i>				
Yes	29	49,2	10	34,5
No	30	50,8	10	33,3
<i>Living area</i>				
Countryside	37	48,1	12	32,4
City	40	51,9	14	35,0
<i>BCS estimation</i>				
Correct	30	39,0	3	7,7
Underestimation	38	49,4	21	42,9
Overestimation	9	11,7	2	22,2

Therapeutic brands are specialised foods prescribed by veterinarians as part of a treatment or prevention plan, such as a specialised renal or urinary diet. The number and percentage of cats per group were calculated (see table 2). Based on the BCS the cat was given by the researcher, the cat was assigned to one of the following three groups: BCS ≤ 5 or no obesity nor overweight, BCS 6 or overweight or BCS > 7 or obese. SPSS 22 was used to calculate the overweight prevalence, obesity prevalence and combined overweight and obesity prevalence within the total sample. The combined overweight and obesity prevalence within each subgroup was also calculated (see table 2).

The SPSS 22 program was also used to perform the statistics on the data set. Cohens kappa was used as a method to determine the agreement between the BCS given by the owner and the BCS given by the researcher. The kappa value was interpreted using the magnitude guidelines by Landis and Koch (19). Following this guideline a $K < 0$ reflects poor agreement, a K of 0 to 0.20 slight agreement, a K of 0.21 to 0.40 fair agreement, a K of 0.41 to 0.60 moderate agreement, a K of 0.61 to 0.8 substantial agreement, and a K above 0.81 almost perfect agreement. One-way analysis of variance (one-way ANOVA) was used to assess the significance of the possible risk factors by comparing the mean BCS between the various risk factors. Risk factors with a $p < 0.05$ were said to be significant risk factors for overweight and obesity.

Results

The sample of the Dutch domestic cat population studied consisted of a total of 77 cats, with a mean age of 7 ± 4.5 (SD) years (range 1-16 years). Of these cats 35 were male and 42 female. 5 cats were intact (6.5 percent) and 72 cats were spayed or neutered (93.5 percent). A total of 9 cats had a medical history that might influence the weight and

BCS. Of these cats four were diagnosed with hyperthyroidism, two with kidney failure, one with diabetes mellitus, one with liver problems and one with liver problems and kidney failure. Most cats (52) were reported as being cross breed (67.5%). Table 2 gives a summary of the demographics of the research population.

The BCS of the 77 cats was assessed by the interviewer. Of these cats 58.4% ($n = 45$) had an ideal body weight (BCS 4-5). 14.3% ($n = 11$) were rated as overweight (BCS 6) and 19.5% ($n = 15$) of the cats as obese (BCS 7-9). 7.8% ($n = 6$) of the cats were classified as lean (BCS 2-3) and none as cachectic (BCS 1). Figure 1 shows the distribution of the BCS within the research population. The combined overweight and obesity prevalence in the sample population is 33.8% ($n = 26$).

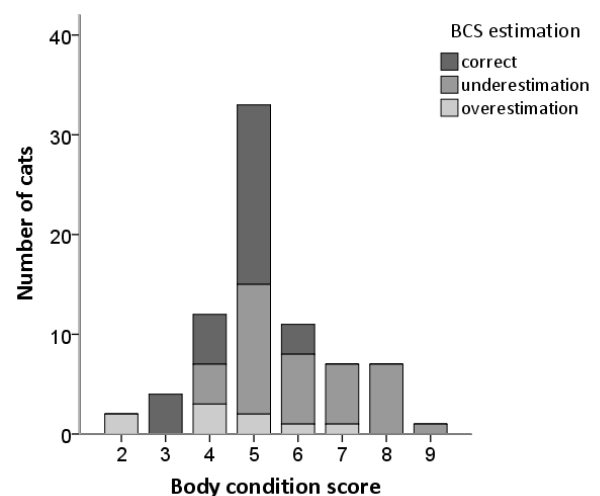


Figure 1: distribution of the body condition score on the nine-point scale. Bars are divided in owner BCS misinterpretation type (correct estimation, underestimation and overestimation)

Of the cat owners 39.0% ($n = 30$) assigned their cat the correct BCS. 11.7% ($n = 9$) overestimated their cats BCS, while 49.4% ($n = 39$) underestimated their cats BCS. Figure 1 shows the amount of correct estimation, underestimation and overestimation per BCS. The Kappa for agreement between the BCS given by the owner and the BCS given by the

researcher is 0.21. This is classified as a fair agreement.

Following the one-way ANOVA test the incorrect BCS estimation by the owner was the only significant potential risk factor for overweight and obesity ($p < 0.05$). The potential risk factors coming nearest to the significance level of $p < 0.05$ are age and the presence of an illness at respectively $p = 0.11$ and $p = 0.13$. None of the other potential risk factors proved significant.

Discussion

The aims of this study were to assess the prevalence of overweight and obesity in the Dutch domestic cat population, to determine the owners ability to define their cats BCS using a visual nine point scale BCS chart and to define basic risk factors for overweight and obesity Dutch cats.

In this study the prevalence of overweight was 14.3%, the prevalence of obesity was 19.5% and the combined overweight and obesity prevalence was 33.8%. This combined prevalence is similar to the prevalence of 35% found in a vet-visiting cat population in the USA by Lund et al(11). The overweight and obesity prevalence of 33.8% is well within the range of prevalences for overweight and obesity found in earlier studies, which ranges from 11% to 52%(2-5,11-13,15).

This study also looked at the ability of the owner to determine the BCS of their cat. A total of 39.0% was able to assign their cat the right body condition score, where 49.4% underestimated their cats BCS. Most underestimations were made when the cat had a BCS of ≥ 5 . Some owners, 11.7%, overestimated their cats BCS. Owner underestimation of the BCS was found in other studies, which also found that the most underestimations of the BCS were made in

cats who have a normal weight or are too heavy(BCS ≥ 5)(12,13,17).

There was a fair agreement between the BCS assessment of the owner and the researcher ($k = 0.21$). This agreement is lower than one found by Courcier et al., who found a moderate agreement with a k of 0.41. In their study 54.2% of the owners were able to estimate the BCS of their cat correctly(13). Another study by Colliard et al. found a fair agreement between owner and researcher BCS estimation ($k = 0.30$) when using a visual scale and a moderate agreement when using a verbal scale ($k = 0.46$)(12). The somewhat higher agreement in both studies when using a visual scale may be partly due to the fact that in both other studies a five-point scale was used instead of the nine-point scale used in this study.

Only one possible risk factor entered in this study was significant after statistical analysis. The underestimation of the BCS by the owner seems to be a risk factor for feline obesity. This is similar to multiple other studies who also identified the underestimation of the BCS by the owner as a risk factor for obesity(12,15,17,20). This risk factor is of particular importance for the management of overweight and obesity. Owners will be less motivated to reduce their cats weight when they don't perceive their cat as too heavy. In order to make weight loss in overweight and obese cats successful it is important to correct the owners perception of the BCS of their cat. Besides correcting the owners perception of the BCS, it may be helpful to explain the health risks of overweight, such as diabetes mellitus and osteoarthritis, to make the importance of weight loss clear(6,12,15,17,18). To prevent the development of overweight and obesity the veterinarian must correct the common view of what a healthy weighted cat looks like(6). This to prevent the owner from

overfeeding a normal weighted cat, cause he or she believes the cat is too skinny.

A factor that was close to significance in this study was the presence of an illness with a known influence on the body weight. This factor did not occur in other studies, due to the fact that in most studies the medical status was either unknown or cats with known medical problems with influence on BCS were excluded from the statistical analysis(2,12,13,15).

The other factor close to significance in this study was age. In some other studies age was a significant risk factor for obesity as well(2,12,15,16). In both of these studies middle aged cats were in higher risk of obesity than young or old cats. Given explanations for this finding are the higher activity level of younger cats and the natural weight loss of older cats(2). In this study there is a peak in the obesity prevalence in cats between 3 and 5 years of age and none of the cats of 15 years or older were obese. However the sample population in this study and the amount of cats in most age groups are small, which makes the comparison prone to mistakes due to coincidence.

One of the main risk factors found in most other studies is neutering (2-5,7,11-13,18). However being neutered was not significant in the present study ($p = 0.51$). This could very well be the result of the small amount intact cats in this study. Only 6.5% ($n = 5$) of all cats were intact with one of these cats being obese (table 1). The main reasons for the higher prevalence of obesity amongst spayed/neutered cats are a lower metabolic rate and energy requirement after neutering combined with an increased food intake(5,7,21,22). The inequality between the neutered/spayed and entire group makes a good comparison impossible. If there had been more intact cats in this study the risk

factor neutering could have been more significant. An additional factor that may have influenced the significance of this risk factor is the awareness of the food restriction needed after neutering by the owner, which is created by more and more veterinarians.

None of the other risk factors for overweight and obesity found in other studies, such as male gender, a diet consisting of premium or therapeutic food, insufficient feeding regimen, or being kept indoors were significant in this study(2,3,5-7,11-13,16-18). These factors were all found in more than one study, but not in all studies who surveyed the risk factors for obesity. Reasons for these inconsistent significance of the various risk factors are the different methods used in the various studies. For example the assessment of the BCS by either the owner, a professional or both and the usage of different visual and verbal scales to determine the BCS. Another important difference is the selection of the study population. For some studies the data was collected in veterinary practices, where other studies collected their data by telephone survey or house visits(2,11,12,15,17,18).

In this study the studied population was small ($n = 77$) and all cats were vet-visiting. Therefore it is possible that the studied population is not representative for the overall Dutch feline population. Thus, all results must be considered with caution.

Conclusion

The prevalence of overweight and obesity in this study was 33.8%. Underestimation of the BCS by the owner was the only found significant risk factor. 49.4% of the owners underestimated their cats BCS. In the future more research must be done to determine more accurate prevalences of overweight and obesity in the Dutch feline

population. Collection of data by house visits throughout the country would provide a more representative research population. A bigger research population is also desired. More research is also necessary to determine the risk factors for obesity, since there is quite some difference in the significant risk factors between studies. More knowledge about the prevalence of and risk factors for obesity is important to provide better weight management programs for cats. Thereby more and widespread knowledge would lead to better understanding of the health risks that come with overweight and obesity

References

- (1) German A. The growing problem of obesity in dogs and cats. *J Nutr* 2006;136(7 Suppl):1940-1946S.
- (2) Russell K, Sabin R, Holt S, Bradley R, Harper EJ. Influence of feeding regimen on body condition in the cat. *J Small Anim Pract* 2000;41(1):12-7.
- (3) Corbee RJ. Obesity in show cats. *J Anim Physiol Anim Nutr (Berl)* 2014;98(6):1075-80.
- (4) Courcier EA, Mellor DJ, Pendlebury E, Evans C, Yam PS. An investigation into the epidemiology of feline obesity in Great Britain: results of a cross-sectional study of 47 companion animal practices. *Vet Rec* 2012;171(22):560-560.
- (5) Harper EJ. Effects of feeding regimens on bodyweight, composition and condition score in cats following ovariohysterectomy. *J Small Anim Pract* 2001;42(9):433.
- (6) Laflamme DP. Understanding and Managing Obesity in Dogs and Cats. *Vet Clin N Am : Small Anim Pract* 2006 11;36(6):1283-1295.
- (7) Fettman MJ, Stanton CA, Banks LL, Hamar DW, Johnson DE, Hegstad RL, et al. Effects of neutering on bodyweight, metabolic rate and glucose tolerance of domestic cats. *Res Vet Sci* 1997 0;62(2):131-136.
- (8) Hand MS, Thatcher CD, Remillard ML, Roudebush P, Novotny BJ editors. *Small animal clinical nutrition*. 5th ed.: Mark Morris Institute; 2010.
- (9) Crane SW. Occurrence and management of obesity in companion animals. *J Small Anim Pract* 2002;32(6):275-282.
- (10) Scarlett JM, Donoghue S. Associations between body condition and disease in cats. *J Am Vet Med Assoc* 1998 Jun 1;212(11):1725-1731.
- (11) Lund EM, Armstrong PJ, Kirk CA, Klausner JS. prevalence and risk factors for obesity in adult cats from private US veterinary practices. *international journal of applied research in veterinary medicine* 2005;3(2):88-96.
- (12) Colliard L, Paragon B, Lemuet B, Bénet J, Blanchard G. Prevalence and risk factors of obesity in an urban population of healthy cats. *Journal of Feline Medicine & Surgery* 2009 2;11(2):135-140.
- (13) Courcier EA, O'Higgins R, Mellor DJ, Yam PS. Prevalence and risk factors for feline obesity in a first opinion practice in Glasgow, Scotland. *Journal of Feline Medicine & Surgery* 2010 10;12(10):746-753.
- (14) Royal Canin weight management program. 2015; Available at: <http://www.royalcaninhealthyweight.co.uk/pet-obesity>. Accessed 05/01, 2016.
- (15) Cave NJ, Allan FJ, Schokkenbroek SL, Metekohy CAM, Pfeiffer DU. A cross-sectional study to compare changes in the prevalence and risk factors for feline obesity between 1993 and 2007 in New Zealand. *Prev Vet Med* 2012 11/1;107(1-2):121-133.
- (16) Sloth C. Practical management of obesity in dogs and cats. *J Small Anim Pract* 1992;33(4):178-182.

- (17) Allan FJ. A cross-sectional study of risk factors for obesity in cats in New Zealand. *Prev Vet Med* 2000;46(3):183.
- (18) Robertson ID. The influence of diet and other factors on owner-perceived obesity in privately owned cats from metropolitan Perth, Western Australia. *Prev Vet Med* 1999;40(2):75.
- (19) Landis JR, Koch GG. The Measurement of Observer Agreement for Categorical Data. *Biometrics* 1977;33(1):159-174.
- (20) Butterwick R. How fat is that cat? *J Feline Med Surg* 2000;2(2):91-94.
- (21) Flynn MF, Hardie EM, Armstrong PJ. Effect of ovariohysterectomy on maintenance energy requirement in cats. 1996; *J Am Vet Med Assoc*.(Nov;209(9)):1572-1581.
- (22) Root MV, Johnston SD, Olson PN. Effect of prepuberal and postpuberal gonadectomy on heat production measured by indirect calorimetry in male and female domestic cats. ;57(3) 371-374. PMID: 8669771. . 1996; *Am J Vet Res*. March(57(3)):371-374.