Effect of weight reduction on clinical signs of lameness in dogs with hip osteoarthritis

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Objective—To determine the effect of weight reduction on clinical signs of lameness among overweight dogs with clinical and radiographic signs of hip osteoarthritis.

Design—Nonblinded prospective clinical trial.

Animals—9 client-owned dogs with radiographic signs of hip osteoarthritis that weighed 11 to 12% greater than their ideal body weight and were examined because of hind limb lameness.

Procedure—Dogs were weighed, and baseline body condition, hind limb lameness, and hip function scores were assigned. Severity of lameness was scored using a numerical rating scale and a visual analogue scale. Dogs were fed a restricted-calorie diet, with amount of diet fed calculated to provide 60% of the calories needed to maintain the dogs' current weights. Evaluations were repeated midway through and at the end of the weight-loss period.

Results—Dogs lost between 11 and 18% of initial body weight. Body weight, body condition score, and severity of hind limb lameness were all significantly decreased at the end of the weight-loss period.

Conclusions and Clinical Relevance—Results suggest that in overweight dogs with hind limb lameness secondary to hip osteoarthritis, weight reduction alone may result in a substantial improvement in clinical lameness. (*J Am Vet Med Assoc* 2000;216:1089–1091)

Osteoarthritis of the hip joints is an important cause of lameness in dogs of all ages.[1] Hip osteoarthritis most often develops secondary to hip dysplasia in dogs,[2] and joint laxity in dysplastic dogs has been shown to be an important risk factor for development of hip osteoarthritis.[3] Various treatments are used for dogs with clinical signs of lameness secondary to hip dysplasia and hip osteoarthritis, including medical treatment with drugs[4] and surgical treatments such as triple pelvic osteotomy,[5] total hip replacement,[6] and femoral head and neck excision.[7]

The prevalence of obesity among dogs in the general population is not well-defined but has been estimated to be approximately 25%,[8,9] and obesity is considered to be the most common nutritional disease of dogs.[10] Obesity is known to be an important risk factor for development of hip osteoarthritis in human beings.[11,12] Similarly, limiting food consumption of dogs susceptible to hip dysplasia during growth and early adulthood to the minimum amount necessary to maintain optimal weight reduces the severity of radiographic signs of hip osteoarthritis.[1] However, it is not known what effect, if any, weight loss will have on clinical signs of lameness in overweight dogs in which osteoarthritis is already established. The purpose of the study reported here was to determine the effect of weight reduction on clinical signs of lameness among overweight dogs with clinical and radiographic signs of hip osteoarthritis. We hypothesized that lameness severity would be significantly improved by weight loss.

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Materials and Methods

Dogs—Client-owned dogs from the Long Island, NY, area examined between July and December 1998 because of hind limb lameness were considered for inclusion in the study. Dogs that had radiographic evidence of hip osteoarthritis and were at least 10% greater than their ideal body weight were eligible for inclusion in the study. Ideal body weight was estimated on the basis of the American Kennel Club's breed standards and the dogs' body condition score. Dogs were included in the study only if results of complete physical and orthopedic examinations did not reveal any other cause of the hind limb lameness. Owners of all dogs included in the study provided informed consent.

Experimental protocol—Dogs included in the study underwent complete physical and orthopedic examinations, and baseline body condition, hind limb lameness, and hip function scores were assigned **(Appendix 1)**. Body condition scores ranged from 1 (thin) to 5 (obese). Hind limb lameness scores were assigned using a **numerical rating scale (NRS)** and ranged from 0 (clinically sound) to 5 (could not be more lame). Hip function scores ranged from 0 (no evidence of pain during manipulation of the hip joint) to 4 (signs of pain during abduction, flexion, and extension of the hip joint and reduced range of motion). Severity of lameness was also assessed by use of a **visual analogue scale (VAS)** that consisted of a 100-mm-long horizontal line with vertical bars at each end and was labelled "clinically sound" (0) at one end and "could not be more lame" (100) at the other end.[13] An examiner observed the dog walking and trotting on a leash and made a mark on the VAS that best represented the gait of the dog. Subsequently, the score was determined by measurement of the position of the mark on the scale. Hip-extended ventrodorsal and lateral radiographic views of the pelvis were examined, and scores for amount of hip joint subluxation and severity of osteoarthritis were assigned. Scores were determined by assessment of both hips together to derive a single score for subluxation and a single score for osteoarthritis **(Appendix 2)**.[4] Baseline CBC and serum biochemical analyses were also performed, but dogs were not excluded from the study on the basis of results of these tests.

After baseline evaluations were performed, dogs were started on a restricted-calorie diet.[a] Owners were instructed to feed their dogs an amount equivalent to 60% of the calories need to maintain their dogs' current body weights; according to the manufacturer of the diet, this type of calorie

restriction would be expected to result in a weight loss of 1.5% per week. Drug therapy or food supplements for treatment of osteoarthritis were not given for the duration of the study. Owners were instructed to maintain their dogs' typical exercise regimen throughout the study; dogs were not placed on a consistent exercise regimen. All dogs were sedentary pets.

Dogs were evaluated until they had lost at least 10% of their initial body weight; 2 additional evaluations were also performed during the weight-loss period. During each evaluation, dogs were weighed, and body condition and hind limb lameness (NRS and VAS) scores were assigned. Dogs were removed from the study if lameness became more severe or if they required medical treatment for any reason. Throughout the study, all clinical examinations were performed and all scores were assigned by a single individual (JAI).

Statistical analyses—Repeated-measures ANOVA was used to examine the effect of time on body weight and VAS hind limb lameness score; differences between times were examined by use of the Tukey post-hoc *t*-test. The Friedman test was used to evaluate the effect of time on body condition and NRS hind limb lameness scores; differences between times were examined by use of the Wilcoxon test. For all analyses, values of $P < 0.05$ were considered significant.

Results

Thirteen dogs were enrolled in the study, but 1 dog died during the study of unrelated causes, and 3 dogs were lost to follow-up. Therefore, information for 9 dogs was available for analysis. No dogs were withdrawn from the study because of signs of worsening pain.

The 9 dogs that completed the study weighed 11 to 12% greater than their ideal body weight at the time of enrollment in the study. Dogs ranged from 6 to 13 years old and weighed between 17 and 52.7 kg (37.4 and 116 lb). Five were spayed females, 3 were castrated males, and 1 was a sexually intact female. Three were Labrador Retriever-type mixed-breed dogs, 2 were Golden Retrievers, 2 were mixed-breed dogs, 1 was a Beagle, and 1 was a Collie-type mixed-breed dog. Mean ± SD hip function scores were 2.3 ± 0.7 and 2.1 ± 0.9 for the left and right hip joints, respectively. All dogs had radiographic evidence of bilateral hip osteoarthritis. Mean ± SD hip joint subluxation and osteoarthritis scores were 2.6 ± 0.5 and 2.4 ± 0.7, respectively.

Table 1—Effect of weight loss on severity of lameness among 9 overweight dogs with hind limb lameness secondary to hip osteoarthritis

	Evaluation period		
Variable	**Baseline**	**Midpoint***	**Final†**
Body weight (kg)‡	39.0 ± 12.0[a]	36.6 ± 11.3[b]	33.4 ± 10.0[c]
Body condition score§	5 (4–5)[a]	4 (3–4)[b]	3 (3–4)[c]
NRS lameness scoreII			
Walking	3 (1–4)[a]	2 (1–3)[b]	1 (0–3)[b]
Trotting	3 (1–4)[a]	2 (1–3)[b]	1 (1–2)[b]
VAS lameness score¶			
Walking	52 ± 22[a]	33 ± 8[b]	14 ± 13[c]
Trotting	61 ± 20[a]	31 ± 7[b]	13 ± 7[c]

*Values obtained at the midpoint of the weight-loss period. †Values obtained at the end of the weight-loss period. ‡Data are given as mean ± SD. §Data are given as median (range). IIRated by use of a numerical rating scale from 0 (clinically sound) to 5 (could not be more lame); data are given as median (range). ¶Rated by use of a visual analogue scale from 0 (clinically sound) to 100 (could not be more lame); data are given as mean ± SD.

In each row, values with different superscripts are significantly ($P < 0.05$) different.

At the end of the study period, dogs had lost between 11 and 18% of their initial body weight. Time required for this weight loss ranged from 10 to 19 weeks. Midpoint evaluations were performed after 3 to 10 weeks. Body weight, body condition, NRS hind limb lameness, and VAS hind limb lameness scores at the midpoint evaluation were all significantly less than values obtained at the beginning of the study (**Table 1**). Body weight, body condition, and VAS hind limb lameness scores obtained at the end of the study were significantly less than values obtained at the midpoint evaluation; however, NRS hind limb lameness scores obtained at the end of the study were not significantly different from values obtained at the midpoint evaluation.

Discussion

Results of the present study suggest that in overweight dogs with hind limb lameness secondary to hip osteoarthritis, weight reduction alone may result in a substantial improvement in clinical signs. Dogs included in the study were representative of breeds susceptible to hip dysplasia. All of the dogs were moderately overweight at the start of the study, and use of the restricted-calorie diet resulted in loss of at least 10% of body weight in 10 to 19 weeks.

In this study, owners were instructed to maintain their dogs' typical exercise regimens because this is the typical situation in clinical practice. In future studies, use of a standard exercise regimen may be preferable to better control the effects of exercise on clinical signs of lameness; however, enforcing standard exercise regimens may be difficult when using client-owned dogs.

Alterations in body condition of dogs in this study were assessed principally by measuring body weight and assigning body condition scores. Because there is evidence that in humans with osteoarthritis, change in body fat percentage is more closely related to degree of symptomatic relief than change in body weight,[14] it may be useful to assess alterations in body fat percentage in future studies involving dogs. Weight reduction in overweight animals is associated with a loss of soft tissue as well as a loss of fat[15]; therefore, it may be helpful to include techniques such as dual-energy x-ray absorptiometry to assess changes in body fat percentage in future studies.[16]

The NRS and VAS, used for scoring hind limb lameness in the present study, are reproducible methods of assessing severity of lameness in animals; however, use of a VAS is a more sensitive method.[13] In the present study, the lack of significant improvement in hind limb lameness scores between the midpoint evaluation and the end of the study was likely attributable to poor sensitivity of this assessment method. In future studies, objective measures of lameness severity, such as force-plate analyses,[4,17] should probably be used.

Although there is clear evidence that obesity is a significant risk factor for the development and progression of osteoarthritis in human beings, the mechanism for this is unclear.[18] Excess body weight will increase stress on weight-bearing joints, and excessive cyclic stresses could contribute to degradation of articular cartilage and remodeling of subchondral bone. Because obesity is also known to be a risk factor for

osteoarthritis of the hand,[12] alternative mechanisms such as metabolic alterations may also be important.[18]

Little is known about what role obesity plays in development and progression of osteoarthritis in dogs. However, results of the present study suggest that weight loss may be useful in overweight dogs with established osteoarthritis. Unfortunately, it was not possible to determine from results of this study whether improvements in severity of lameness would be sustained over the long term or whether lameness would become progressively more severe, particularly if weight was regained. However, improvements in lameness severity would likely lead to improved muscle tone and bulk, which could contribute to ongoing clinical improvement.

[a]Eukanuba Veterinary Diets, Nutritional Weight Loss Formula, Restricted-Calorie/Canine, The Iams Co, Dayton, Ohio.

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Appendix 1

Numerical rating scales for assessing severity of clinical signs of lameness in dogs

Body condition score

Score	Criteria
1 (thin)	Ribs, lumbar vertebrae, and pelvic bones easily visible. No palpable fat. Obvious waist and abdominal tuck. Prominent pelvic bones.
2 (underweight)	Ribs easily palpable with minimal fat covering. Waist easily visible when dog viewed from above. Abdominal tuck evident.
3 (ideal)	Ribs palpable but not visible. Waist evident behind ribs when dog viewed from above. Abdominal tuck evident when dog viewed from the side.
4 (overweight)	Ribs palpable with slight excess of fat covering. Waist evident when dog viewed from above, but not prominent. Abdominal tuck apparent.
5 (obese)	Ribs not easily palpable under a heavy fat covering. Fat deposits over lumbar area and tail base. Waist barely visible or absent. No abdominal tuck. May have obvious abdominal distension.

Hind limb lameness score

Score	Criteria
0	Clinically sound.
1	Barely detectable lameness.
2	Mild lameness.
3	Moderate lameness.
4	Severe lameness (carries limb when trotting).
5	Could not be more lame.

Hip function score

Score	Criteria
0	No signs of pain during hip joint manipulation. Normal range of motion.
1	One of the following abnormalities: Signs of pain during abduction of the hip joint; Signs of pain during flexion of the hip joint; Signs of pain during extension of the hip joint; Reduced range of motion.
2	Two of the abnormalities listed for a score of 1.
3	Three of the abnormalities listed for a score of 1.
4	All of the abnormalities listed for a score of 1.

Appendix 2

Numerical rating scales used to evaluate severity of radiographic abnormalities in the hip joints of dogs*

Hip joint subluxation score

Score	Percentage of subluxation†
1 (slight)	60–64
2 (mild)	55–59
3 (moderate)	50–54
4 (severe)	45–50
5 (extreme)	< 45

Osteoarthritis score

Score	Criteria
1 (slight)	Periarticular osteophytes only.
2 (mild)	Periarticular osteophytes and femoral head remodelling.
3 (moderate)	Periarticular osteophytes, femoral head and neck remodelling, and acetabular remodelling.
4 (severe)	Periarticular osteophytes, femoral head and neck remodelling, acetabular remodelling, and sclerosis of the subchondral bone of the femoral head and acetabulum.

*Extended-hip radiographic views of the pelvis were evaluated. †Calculated by measuring the percentage of the femoral head medial to the shadow of the dorsal aspect of the effective acetabular margin.