



Research

Owner's perception of changes in behaviors associated with dieting in fat cats



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ABSTRACT

Fifty-eight obese cats were fed 1 of 3 equicaloric diets for 8 weeks: a high-fiber (HiFi) diet, a control diet formulated to maintain weight in adult cats, or a low-carbohydrate and high-protein diet. The cats' changes in weight at 4 and 8 weeks were compared with baseline weights. Behaviors at 4 weeks were compared between diet groups. Whether the cats differed in behaviors compared with baseline was compared at 4 and 8 weeks without regard to diet. The behaviors were recorded by the owners and analyzed for direction of the change (if change occurred). The behaviors were prefeeding begging, following, meowing, and pacing. Those recorded postfeeding and similarly analyzed were jump in lap, purr, rest, sleep, and use litter box. The owners were also asked whether the cat's affection toward them had changed since the diet was fed. Most of the cats (38 of 47; 81% of those with data for that time) lost weight during the first 4 weeks, irrespective of the diet; there was no difference in percentage of original body weight lost at 4 weeks between the diets ($P = 0.36$). However, the HiFi group lost relatively more weight across the entire 8 weeks than did the low-carbohydrate and high-protein diet group ($P = 0.0075$). Overall, 38 of 50 (76% of cats with data for that time) of all cats had weight losses at 8 weeks.

Irrespective of the diet, many cats reacted to caloric restriction by intensifying their appetitive behaviors. Of the cats that had changed the frequency of the particular behavior at 4 weeks, most increased the frequency: begging (32 of 41 increased), following (35 of 37), meowing (34 of 38), and pacing (30 of 31) before the meal (all $P \leq 0.0001$); however, the cats did not begin to beg earlier during food restriction ($P = 0.47$). The cats also increased the 4-week postmeal (satiated) behavior for jump in the owners lap (14 of 15 increased) and use the litter box (12 of 13) (both $P \leq 0.005$). Affectionate behavior increased in most cats (30 of 32 with change at 4 weeks; $P \leq 0.001$). The changes in behaviors at 8 weeks generally followed the same patterns except that purr became significant, and both beg and use of litter lost significance.

A HiFi diet led to more weight loss at 8 weeks than an equicaloric and high-protein diet, but the type of diet did not affect appetitive and satiated behaviors. Of the cats that changed behaviors, the appetitive behaviors typically increased, and the owners felt that their cats displayed more affection.

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Introduction

Obesity in cats has been defined as 25% or more over the cat's ideal body weight (Zoran, 2009). A study of 2000 cats from 31 veterinary hospitals in eastern United States found that 20% of the cats were overweight and 5% were obese (Scarlett et al., 1994). A

large study based on body condition scores indicated that more than half of the pet cats were above optimal body condition (Lund et al., 1999). A more recent study indicated that 35% of the feline population is obese (Zoran, 2009). Overweight or obese cats are more likely to develop health problems. These health problems include lameness, diabetes mellitus, and nonallergic skin conditions (Buffington, 2002; Michel and Scherk, 2012), although there are few studies proving that obesity causes these problems rather than being associated with them. In addition, the ability to perform a thorough and adequate physical examination on an obese cat can be hindered because of the cat's size. Overall welfare is decreased if

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the cat is obese because of the myriad health problems. Factors that have been associated with feline obesity are living in an apartment, being a single cat, male, mixed-breed neutered or inactive, and being fed a specialty or prescription diet (Scarlett et al., 1994). Cats that live in apartments cannot climb stairs or travel more than a few meters in any direction; therefore, they do not expend as many calories. Male cats seem to be more sedentary, and castration only intensifies their inactivity. Neutering decreases feline maintenance energy requirements (Mitsuhashi et al., 2011). Prescription diets are very palatable so the cats consume more calories. Single cats have no other cat with which to play—or fight—so are less active than cats in multicat households. Free-choice feeding in which the cat can eat *ad libitum* is another risk factor for obesity. Owners are often reluctant to impose a weight loss program on their cats because they think the cats will be less affectionate and will beg all the time. They fear that the cat will no longer like them and do not want the cat to exhibit annoying behaviors.

There are many diets on the market to help cats lose weight. These diets vary in their nutritional content. Because cats are obligate carnivores and their natural diet consists of eating many (approximately 12 mice) rodents per day (Fitzgerald and Turner, 2000), one might hypothesize that a low-carbohydrate and high-protein (LoChoh) diet would reduce food-demanding behavior more than a high-fiber (HiFi) diet and would allow for a greater weight loss than a HiFi diet. This hypothesis is supported by studies in cats (Vasconcelos et al., 2009) indicating that weight loss is greater or sustained longer when a high-protein diet is consumed.

Feeding behavior can be divided into 3 phases, appetitive behavior, consummatory behavior, and satiety. Consummatory behavior is eating the food. Feline appetitive behaviors have not been well documented but could consist of biting or pouncing behavior because cats are predators or, if cats consider their caretakers as they do their mother, they may vocalize. Satiety behaviors could consist of playful behavior, because cats often play with their prey, but may also include rest and elimination behavior (Leyhausen, 1979).

Because owners have difficulty in reducing their cats' food intake, this study focuses on whether and how cats' behavior change when they are food restricted (Kienzle and Bergler, 2006). Our study had 2 primary objectives and 1 secondary objective. Our primary objectives were to quantify how a cat's behavior changes when its food intake is reduced and to determine which of these diets the owners believed made the cats feel more satiated.

A secondary objective was to determine whether percentage weight loss was greater with a high-protein diet than with a HiFi diet or a control diet after 4 and 8 weeks of consuming the assigned diet.

Methods

Recruitment, assignment, and eligibility criteria

Fifty-eight neutered cats (Table 1) were enrolled in a placebo-controlled study in which both the owners and the veterinarians

Table 1
Characteristics of cats participating in dietary restriction

Diet	Sex (number of cats)		Age (y)	Cats on a restricted diet before the study began	
	Male	Female	Mean ± standard deviation	%	Fraction
Con	10	8	8.4 ± 4.1	23	3/13
HiFi	10	9	6.1 ± 2.3	47	7/15
LoChoh	5	14	7.8 ± 3.4	27	4/15

Con, control diet formulated to maintain weight in adult cats; HiFi, high-fiber diet; LoChoh, low-carbohydrate and high-protein diet.

(who weighed the cats) arbitrarily were unaware of the formulation of the diets. The diets were coded LMN, PQR, and STU so that the owners and veterinarian did not know the composition of the diet. The owners were recruited via advertisements in local newspapers and on local radio and television stations. Each cat was assigned systematically (by household, if there were multiple cats) to 1 of 3 treatment groups: HiFi group, LoChoh group, or a control diet formulated to maintain weight in adult cats (Con) group (Table 1). The codes were not revealed to either the researchers or the owners until all the data were collected and entered into a statistical program; the statistician was blind as to the diet composition during the data analyses. The protocol was approved by the Cornell University Institutional Animal Care and Use Committee.

The cats had to be 25% or greater over their ideal body weight (defined as their weight at 1 year [larger breed cats, such as ragdolls and Maine coon cats may not reach adult size until 15–18 months, but these cats were not of those breeds] because any gain thereafter would not be because of growth) and could not have any other important abnormalities on the physical examination or blood tests. The blood tests included a complete blood count (hematocrit, hemoglobin, red blood cell number, and white blood cell number), chemistry panel (total protein, albumin, globulin, alkaline phosphatase, urea nitrogen, alanine transaminase, creatinine, and glucose), and a total tetraiodothyronine level. The complete blood count was made to determine if the cat was anemic or had an infection. The chemistry panel was done to assess liver, kidney, and muscle functions. The thyroxine levels were measured because hyperthyroidism is a common problem of middle-aged cats but usually causes weight loss. The cats had to be kept strictly indoors (to assure no caloric supplementation) so only normally indoor cats were enrolled. The owners needed to be able to monitor their cats' environment so that the cats had no access to human or other pets' food in the house. The owners had to return to Cornell to have their cats weighed at least every 4 weeks but were strongly encouraged to come every 2 weeks.

Study protocol

Weight-loss component

The length of time each cat was required to be on the study was 10 weeks. The first 2 weeks of the study was simply the time allotted for the owners to switch their cats gradually from their regular diet to the test diet. The owners did not have to limit their cat's food intake during these 2 weeks; therefore, no weigh in was required after these initial 2 weeks. Cats that rejected the diets were not included in the study. For the remaining 8 weeks, each owner was instructed to feed a specific amount of food to his or her cat over a 24-hour period. For example, a cat whose ideal weight is 4.5 kg would be given 1/3 cup (79 mL by volume) of the LoChoh or Con diet or 2/3 cup (158 mL) of the HiFi diet. The nutritional components of each diet are given in Table 2. To encourage compliance and avoid any errors, each owner was given a measuring cup with a line indicating the specified amount of food for their cat. If any cat refused to eat for a period of 48 hours, the owner was instructed to offer the cat's regular cat food and immediately to call the Cornell University Hospital for Animals.

Each cat received a physical examination at the Cornell University Hospital for Animals. At this time, the cat's weight was recorded, blood tests were performed, and an estimation of the cat's ideal body weight was made (Butterwick, 2000). If the owners knew the weight of the cat when it was 1 year old, that weight was used as the ideal target weight. If its weight at 1 year was not known, 2 measurements were made to estimate the ideal body weight. The measurement included the length from the cranial aspect of the scapula to the base of the tail and from the dorsal

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