Dier-en-Arts 2018; Nr 8/9: 186-189.

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Cat food composition and caloric intake*

*Condensed version of article in Dutch (1)

Summary

Caloric intake by free-fed cats depends on diet composition. In experiments lasting two weeks to one year, cats fed ad libitum ingested less energy on dry diets high in carbohydrates, or either low in fat or protein. Unlimited access to high- versus low-fiber diets also depressed the intake of calories. Cats voluntarily consumed less energy when fed wet instead of dry food. With a view to suppress caloric intake and obesity development in free-fed cats, an ideal composition of dry food is proposed. However, it is unknown whether such a diet leads to a lower, stable body weight in the long term.

Introduction

One educational concept of basic nutrition is that animals, regardless of food composition, consume a constant amount of energy, provided they have free access to food. With increasing metabolizable calories per weight unit of food, consumption falls and vice versa. Research data indicate that the concept of self-determined, constant intake of energy does not hold for cats.

High versus low fat

Neutered cats were fed ad libitum on a low-fat food followed by 21 days on a very-high-fat food (2). The semipurified, dry diets contained 15 and 45 weight% fat. The extra fat, which was added at the expense of an equal quantity of weight of carbohydrates, raised energy density from 1.83 to 2.46 MJ/100 g diet and changed the distribution of dietary calories (energy% protein: energy% fat: energy% carbohydrates) from 26:30:44 to 19:68:13. On the high-fat diet, the cats decreased their meal size and left meal frequency unchanged, so that caloric intake remained virtually constant. The study corroborates constancy of eating energy, but longer-lasting studies, as discussed below, do not.

De-sexed and intact cats were given free access to a dry food with energy distribution of 34:25:41 or 30:41:29, and energy density of 1.60 or 1.87 MJ/100 g (3). After 26 weeks, all cats had gained weight, with extra increase on the high-fat diet. For the four animal categories, mean fat-induced body-weight gain was 10.0%. Throughout the experiment, food intake was variable, but in the main lower for the high-fat food. Nevertheless, energy intake with the high-fat diet was on average 16% higher. Clearly, the lower intake did not nullify the food's higher energy density.

Another publication (4) also describes the effect of dietary fat in exchange for carbohydrate. The semipurified, dry foods contained either 9, 22, 44 or 64% calories from fat, but all diets contained 33 energy% protein. Each diet was freely available to a group of male and female cats, for 13 weeks before and 17 weeks after their gonadectomy. Final body weight correlated directly with dietary fat level, but not demonstrably so with energy intake. An increase in energy density, from 1.77 to 2.01

MJ/100 g dietary dry matter, through raising dietary fat from 25 to 44 energy% fat, raised body weight by 8.5 and 8.3% in females and males. This outcome endorses the earlier study (3).

High versus low protein

For 4 months, neutered cats (n= 10/group) with overweight (mean body weight = 6.0 kg) were fed ad libitum on dry foods with energy compositions of 27:44:29 and 47:45:8 (5). The protein-rich food increased dry matter and energy intake by about 17% each. In another experiment, cats (n=4/group) were given copious amounts of wet food, with 20:59:21 or 37:57:6 as energy profile, for one year (6). Caloric intake was 29% higher on the high-protein food. Thus, replacement of carbohydrate by protein may raise energy intake, but this was not seen in cats fed semipurified diets (7).

In two studies of the same investigators, the test foods were enriched with protein at the expense of iso-energetic amounts of fat (8, 9). The wet foods were administered ad libitum to six castrated cats for periods of 50 or 14 days. The contrasted dietary energy distributions were 35:62:3 and 52:45:3 (8), and 20:70:10 versus 70:20:10 (9). The high-protein foods increased group-mean energy intakes by 6 and 43%. Thus, not only isogravic replacement of carbohydrates by protein, but also isocaloric replacement of fat by protein, promotes energy intake, pointing to a specific protein effect.

High versus low fiber

Crude fiber consists of cellulose, hemicelluloses and lignin. Cellulose fiber, a glucose polymer with β-1,4-glycosidic bonds, provides zero calories to cats. In the feline intestinal tract, cellulose is neither digested nor fermented (10 -13). Cellulose is more than caloric diluter as it also lowers the digestible energy content of cat food. An increase by 1% cellulose in the dry matter of cat food is associated with a decrease in the apparent digestibility of dietary gross energy by 0.94% unit (14).

In 7 studies, cats consumed as they wished foods with different cellulose contents (15-21). On average, the studies' features are as follows: contrast, 10.0 versus 2.7% crude fiber in the dietary dry matter; number of cats per diet, 4.4; duration of feeding, 16.1 days. Dry matter intake was 1.8% lower on the high-fiber diets (22). Mixing crude fiber into a dry food (1.50 MJ/100 g), thereby increasing the level from 2.7 to 10.0%, would lower daily energy intake by 9%. Evidently, more crude fiber in the food hardly affects dry matter consumption so that energy intake falls.

Feeding a diet high in crude fiber may lead to weight loss. Ten cats (mean body weight = 6.6 kg) kept in a research facility were switched from a regular food (1.1% crude fiber) to a high-fiber food (11.4% crude fiber) which was supplied in excess (21). During 8 weeks on the high-fiber diet, food and energy intake were 3.2 and 17.3% lower, and body-weight loss was 0.57% per week. Similar weight loss was seen in obese cats subjected to dietary energy restriction in the home setting (23, 24).

Wet versus dry food

Blending water with dry food leaves the composition and energy value of the dietary dry matter unchanged, but lowers caloric density and affects texture and aroma of the product as fed. In three experiments, cats had free access to dry food without or with added water (25-27). The diluted foods with on average 67% water lowered dry matter intake by 6%, and thus energy intake also. The same effect was seen after freeze drying of wet food. Cats consumed 26% less dry matter when free-fed the original canned food compared with the dehydrated form (28).

Comparisons of commercial wet and dry foods support the studies on food hydration or dehydration. Seven publications (27, 29-34) describe studies in which cats unrestrictedly consumed dry or wet foods for periods lasting 5 to 25 days. When wet food was provided in place of dry food, dry matter and energy intake were on average 33 and 10% lower (35). One wet food increased energy intake, but the dry matter of this product was energy-rich as it contained 49% fat (34).

Practical considerations

Roughly speaking, 60% of the house cats in westernized countries is fed ad libitum (36-41). This feeding practice, which correlated with obesity in just one sample of a cat population (42), promotes weight gain in controlled studies, especially in de-sexed animals (3, 43-48). About 90% of the pet cats receives industrially prepared food as sole nutrition. For 58% it is a combination of dry and wet food and for 27% dry food only (36-38, 49). Only one study found an association between fat-rich dry food and feline obesity, which involved cats presented to veterinary hospitals (50).

The above-described data from controlled feeding studies show that free-choice feeding of fatty food enhances caloric intake and weight gain. These observations could refer to plentiful high-fat food as risk factor of feline obesity. Moreover, the feeding studies have shown that unlimited availability of high-protein and low-fiber food may increase energy intake.

In order to dampen weight gain in cats with free access to dry food, a suitable dietary composition can be suggested. The ideal dry food, with energy density of about 1.50 MJ/100 g, would contain ≈26% protein (30 energy%), ≈10% fat (25 energy%), ≈42% carbohydrates (45 energy%) and ≈5% crude fiber. Switching cats from regular dry food to the ideal formula is anticipated to depress voluntary energy intake by at least 10%. Noteworthily, commercial foods with neutered cats as target group, and purporting to help fighting obesity, can deviate substantially from the ideal composition (51).

No association between feline obesity and type of food, dry or wet, was found in population samples (42, 52, 53). Paradoxically, when cats with unlimited access to food are switched from commercial dry kibbles to a wet product, energy intake may fall by 10%, provided that the wet food is fat-restricted (≤ 20% fat in the dry matter). Only about 6% of the cats receives wet food only (36-38, 49), presumably due to relatively high feeding cost and the nuisance that moist food loses its freshness and hygiene while sitting in the bowl continuously.

On a practical note, the energy intake response to diet change can differ considerably between individual cats. Furthermore, the expected effects are mainly based on short-term studies. Thus, it is unknown whether ad libitum feeding of dry food with the ideal composition in the long term leads to a new steady state with lower energy intake and lower body weight. It is therefore still prudent to feed cats portion-controlled, using their body condition as compass.

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