NEUTERING CATS AND ITS IMPACT ON WEIGHT AND BODY CONDITION

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MARGE CHANDLER discusses medical conditions and genetic factors linked to obesity, and how neutering can impair a cat's willingness to take exercise

OVERWEIGHT body condition and obesity are the most common nutritional disorders that occur in companion animals in many countries.

One estimate points to a 400 per cent increase in UK cases in the past 25 years. Surveys have reported incidence rates of between 24 per cent and 59 per cent in adult dogs. Until recently, it was generally believed obesity in cats was less prevalent, but recent studies of house cats reported that between 19 per cent and 52 per cent of the cats seen by veterinary surgeons were considered overweight or obese. Obesity is linked to many medical conditions in cats, including diabetes mellitus, dyslipidemia, osteoarthritis, hepatic lipidosis, non-allergic skin disease and obstructive urethral disease in males. Unfortunately, even where weight loss is achieved, there is a high rate of weight regain.

Aetiology of obesity

Generally, the underlying cause in most cases of feline obesity is an imbalance between energy (calorie) intake and energy expenditure, which results in persistent energy surplus. Excess energy is stored primarily as fat. This is a somewhat simplistic version of the aetiology, as genetic components also contribute hugely, and the owner's psychological aspects of feeding pets are substantial.

Several risk factors for obesity in cats have been identified. These include inactivity, indoor living, feeding free-choice food, diets with high palatability, highfat diets, excess food provided by owners, feeding treats and the inability of individual owners to recognise overweight body condition in cats (Figure 1).

Feeding energy-dense kibble has been implicated, although other studies show the type of food had little to no influence. Orthopaedic disorders can impair the cat's ability and willingness to exercise. However, the risk factor most commonly recognised, and the one considered to be most significant, is neutering.

Neutering

Un-neutered adult cats generally weigh less than neutered animals of the same breed. Owners are generally encouraged to neuter their pets between five months and one year of age, and some rescue shelters neuter early to help decrease the risk of unwanted litters.

Early neutering at seven weeks of age did not increase the risk of weight gain in one study more than for those cats neutered at seven months of age. However, younger female adult cats (aged less than four) appear to gain weight more easily than female cats older than four years at the time of neutering. The reasons for this are not clear, but may include more established feeding patterns or less effect on metabolic rate in older cats.

Several factors may influence the cat's tendency to gain weight after neutering. These include a decreased basal metabolic rate, decreased activity and an increase in food intake.

A study in kennelled female cats showed their maintenance energy requirements (MER) decreased by 25 per cent and their bodyweight increased by 16 per cent after spaying compared to un-neutered cats. These cats were first allowed to gain weight and their MER values were calculated after weight loss. Basal metabolic rate may decrease during the weight loss, which may have influenced the decreased MER in these cats.

After weight loss due to calorie restriction, energy expenditure may decrease, making it easier to regain weight, and the energy expenditure remains low after weight is gained again – although one study showed conflicting results in that it was thought cats gained weight due to increased food intake rather than decreased energy expenditure.

A decrease in activity is also a possible contributing cause to post-neutering weight gain. However, a difficulty in assessing this is that many of the studies are in research cats that are kennelled rather than cats in a home or outdoor environment. No difference in activity was noticed in one study between intact and neutered research cats housed indoors, although these cats were only studied for five to 10-minute periods. Another study more convincingly showed a decrease in activity of female cats after neutering by using activity collars that measured the cats' activity

across 24-hour periods. A study looking at the effects of neutering on male and female feral cats judged the cats became heavier and less inclined to roam after neutering, although this was subjective.

Effects of oestrogen

Oestrogen concentrations are decreased after neutering in both male and female cats (Figure 2). The effects of oestrogen on metabolic rate and disease risk are evident, but poorly understood. In rats, oestrogen concentrations have been associated with increased voluntary exercise, with ambulatory activity decreasing after ovariectomy. Whether this occurs in cats is not known, although, as noted previously, the evidence for decreased activity is good.

As well as its role in energy storage, fat or adipose tissue is also recognised as an active endocrine organ intricately involved in energy homeostasis and metabolism. For example, as adipose cells increase with weight gain and obesity, the production of the adipokine hormone leptin is increased. Increased leptin should function to decrease food intake and fat stores. However, in obese individuals resistance can develop to these effects.

The primary centre for food intake and satiety is in the hypothalamus, and there are many hormonal inputs into this centre. Oestrogen not only has receptors in the hypothalamus, but has also been shown to interact with leptin and increase its action, suggesting a role in appetite regulation. In one study, adipose leptin mRNA was dramatically decreased after spaying in cats that also had food restriction.

Oestrogen also has an effect on the amount of food consumed. Studies have shown an increase in food intake in female and male cats after neutering, with the consequent weight gain largely consisting of fat. One study showed a 40 per cent increase in fat mass, but only 10 per cent increase in lean mass tissue after neutering. Administration of oestradiol to cats after neutering almost completely prevented the increase in food intake, bodyweight gain and increased body fat mass.

These findings are similar to those from studies of rodents, demonstrating the importance of oestrogen in modulating cholecystokinin (CCK)-dependent satiety signals that contribute to the control of food intake. Two studies have also looked at the effects of genistein, an oestrogenic isoflavone, on the food intake and body composition in cats after neutering. Genistein provided a short-term (five day) decrease in food intake after neutering, but this was not maintained in a 35-day longer study.

In the longer study, the cats given genistein had similar food intake and weight gain as untreated neutered cats, but the cats did show increased lean body mass and less body fat accumulation. Studies in rats using genistein have also shown an inhibited lipogenesis in vitro, and promotion of lean body mass deposition without a reduction in food intake after spaying.

Altered glucose and lipid metabolism accompany bodyweight gain and differences are recognised in skeletal muscle and adipose tissue after spaying. Skeletal muscle plays an important role in glucose metabolism and accounts for approximately 80 per cent of insulin-mediated glucose uptake, a response that is diminished in obese individuals and contributes to the risk of type two diabetes mellitus. The metabolic dysfunction that occurs in muscle after spaying, with bodyweight gain, or both, is not entirely understood, but may be partly attributed to lowgrade inflammation.

Obesity is usually recognised as a state of chronic inflammation with increased circulating cytokines, and much of this inflammation is thought to be derived from inflammatory mediators produced by immune cells present in adipose tissue. Oestrogen receptors are expressed in several cell types in adipose tissue, including preadipocytes and macrophages, and elevated proinflammatory cytokine concentrations have been reported in cats following spaying. The role of neutering in the development of the inflammatory state needs further investigation.

One suggestion is the set point for appetite and weight of a cat may be adjusted by neutering, leading to increased food intake and potential obesity. Changes in gene expression and physical activity result due to decreased oestrogen and potential targets for nutritional intervention or lifestyle management have been identified. In humans, there is considerable research showing overweight body condition, feeding behaviour and activity levels have a strong genetic basis, with at least 189 genes related to obesity having been identified. Nutrigenomics is the study of the interaction of dietary components with the genome and the resulting proteomic and metabolic changes. Nutritional intake alters the expression of genes and the genetic variations can have a significant effect on the metabolic response to food. Related cats under the same environmental and nutritional management may have differences in their tendency to gain weight, and many households have a fat cat and a lean cat (Figure 3).

The veterinary appointment at the time of neutering is a crucial point for a discussion about diet and obesity with the owner. The owner should be informed of his or her cat's current weight and taught how to body condition score the animal. Many cats have a maintenance calorie requirement 25 per cent lower than prior to neutering, so cats will often start to gain weight and body fat within two weeks of a procedure. In these cats, the amount and/or the type of food provided should be adjusted to maintain ideal body condition.

It is much easier to prevent weight gain than to lose fat that has accumulated. The yearly veterinary visits should always include a nutritional assessment and diet recommendations.

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