NEUTERING: CAN OBESITY BE AVOIDED?

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Introduction: Obesity and excess body weight (BW) are one of the most common nutritional diseases in small animals. The most recent studies report an incidence of 17 to 52 % in cats (1,2,3,4,5,6,7,8) and 20 to 44% in dogs (1,9,10,11,12). Several factors contribute to this condition, including sexual status. Neutering is a risk factor of obesity, with neutered cats 2.8 to 3.4 times more likely to be obese than sexually intact cats (3,6). In dogs, gonadectomy increases the incidence of obesity in males and especially in females (9,13,14,15,16,17). Neutered female dogs are twice as likely to be obese as entire females (9,13,17). Twenty seven % of neutered dogs would be obese (18).

Obesity and neutering: The mechanism by which neutering causes obesity has been investigated. Gonadectomy appears to induce changes in daily energy requirement and feeding pattern.

An early study in cats showed that metabolic rate, estimated by heat coefficient, was 28% and 33% lower in neutered males and females, respectively (19). These results suggested that about 30% decrease in energy intake is necessary after gonadectomy, which was confirmed in female cats by Harper et al (20). Flynn et al (21) also found that energy intake to maintain BW was 24-30% lower in spayed cats, compared to control cats. One study (22) showed lower results: a 15% decrease in energy allowance was necessary to maintain BW in male and female cats, but the difference was significant only for female cats. However the decrease in metabolic rate after gonadectomy is debated. The decrease in metabolic rate would be significant only in female cats (23). Energy expenditure on a lean mass basis would not be significantly different after neutering and the BW gain would be only due to the modification of feeding behaviour in male as in female cats (23,24,25,26). The decrease in metabolic rate would be due to the modification of body composition (24,25,26). Food intake increases immediately following neutering, leading to BW gain, mainly in the form of fat (20,24,25,26). Neutered male and female seem to be unable to self regulate food intake over the short term (21,27). The effects of gonadectomy on physical activity of the cats have not been fully investigated but a decrease in activity is suspected, linked to the suppression of sexual behaviour (28).

In dogs, gonadectomy seems also to result in modification of feeding pattern. Compared to control female dogs, ovariectomized bitches fed *ad libitum* for 3 months after surgery ate significantly more food (+20%) and gained more BW and fat (29,30). Another study in 209 male and 382 female owned-dogs showed an increased intake of food after neutering in 42% of male and 32% of female dogs that led to an increase in BW (31). A study in female Beagle dogs found that energy intake has to be reduced by 30% after ovariectomy to maintain optimal BW for a period of 6 months (32,33). These results confirmed those of a previous experiment showing that energy requirements are 20% lower after gonadectomy in female dogs and this could be imputed for a half to an activity decrease (34). Indeed, a decrease in activity, as indicated by an increased time of rest and a decreased motivation to move, was observed after neutering in male and in female dogs (31). A decrease in sexual behaviour could also be implicated (35). The effect of gonadectomy on metabolic rate has not been evaluated in dogs. The control of energy intake is necessary for a long period of time: 6 months after surgery, while BW was maintained by controlled energy intake, a 59% increase in food consumption was observed in neutered female dogs fed *ad libitum* a palatable diet for a period of 4 months. Energy intake increased the first month (+80%) and then decreased (32). This modification of feeding behaviour could be linked to increased ghrelin concentration, an orexigenic hormone. Increase in energy consumption leads after 4 months to an important BW gain (+22%), that consists exclusively in fat gain (33).

Today, the exact cause of these modifications of metabolic rate, feeding patterns or body composition is not fully understood. In female, food consumption varies during oestral cycle: it is minimal during oestrus, increases during metoestrus and reaches maximum during anoestrus (30). In female, neutering could suppress the anorexigenic effect of oestrogen. Now, studies start to focus on hormones involved in glucose and fat metabolism, energy balance or adipose tissue development.

Obesity prevention after neutering: Obesity represents a major health risk. Obese cats are at risk for hepatic lipidosis, hyperlipidaemia, diabetes mellitus, lameness, non-allergic skin disease or death at middle age. Obese dogs can present glucose intolerance, hyperinsulinemia, hyperlipideamia, effort and heat intolerance, respiratory and cardiovascular disease or lameness. Moreover, a recent study in dogs has demonstrated that obesity and excess energy intake reduced life expectancy (36). In regards of these observations, a strict control of BW after gonadectomy, either in dogs or cats, seems particularly relevant.

A first way to achieve this objective is to control energy intake. In female dogs, the control of food intake after gonadectomy maintained an optimal body composition: the ratio fat free mass on fat mass was improved (33). A 20-30% decrease in energy intake seems necessary. The same observation was done in female cats: a 15-40% energy restriction maintained optimal BW and body composition (20,21,22). Some neutered adult cats could have energy requirement lower than 40 kcal/ kg /day (20). However, individual energy requirement are highly variable and it is therefore difficult to make recommendations. A regular control of BW and the adaptation of food quantity remain the corner stone to prevent obesity in males and in females.

The restriction of energy intake can be obtained by a modification of the diet composition. In cats, the free access to a low-fat low-energy diet reduced the BW gain after gonadectomy, compared to a high fat, high-energy diet. However, the modification of the diet composition alone did not completely prevent the BW gain (26).

Ad libitum feeding is not recommended, all life long. In neutered male and female cats, this feeding mode leads rapidly to an increase in BW (until 55 % after 26 weeks) and body fat (20,24,25,26). Similar results were observed in female and male dogs (29,30,31,32,33).

Another way to prevent BW gain is to increase energy expenditure. Ovariectomized bitches fed a fixed amount of food and exercised regularly gained no BW (37). The control of food intake and exercise allow the recovery of optimal BW in 90% of dogs (38). This method of prevention has not been evaluated in cats.

A recent study in dogs (18) has also shown a positive relationship between age at neutering and obesity prevalence. Early gonadectomy could be recommended. However, in cats, the same decrease in estimated metabolic rate has been observed, with gonadectomy at 7 weeks or 7 months of age (19).

If obesity develops, a weight loss diet has to be prescribed as soon as possible, before metabolic complications appear. Indeed, it was shown in neutered female dogs that modifications in blood lipids or insulin concentrations were not significant during the dynamic phase of obesity, compared to the static phase (32).

Conclusions: A strict control of BW has to be set up quickly after gonadectomy in dogs and cats. Indeed, modifications of feeding behaviour and energy requirements predisposed neutered dogs and cats to obesity. Control of food intake and exercise are recommended.

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