Other Risks/Possible Benefits of Obesity

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KEYWORDS

• Obesity • Hyperlipidemia • Adipokines • Renal • Quality of life

KEY POINTS

- Obese individuals have changes to the intestinal microbiome that may influence overall health and well-being.
- Adipocytes produce cytokines that may act to promote neoplastic changes to other cell lines.
- Obesity is considered a significant risk factor in development of chronic renal failure in people; in dogs, obesity can lead to altered renal function and histologic changes to renal architecture.
- Obese and overweight dogs have lower quality of life assessments and potentially shorter lifespan relative to lean dogs.

INTRODUCTION

Before the discovery of leptin, any adverse effects of obesity were attributed to mechanical stress on cardiovascular and musculoskeletal systems, but now it is known that adipocytes secrete hormones and cytokines that can have long-term adverse effects on health and wellness[1] (please see Clark M, Hoenig M: Metabolic Effects of Obesity and Its Interaction with Endocrine Diseases, in this issue). Obesity results in a chronic inflammatory condition[2] that can predispose the individual to development of diabetes mellitus, hypertension, and nonhypertensive renal disease.[3] Obese people, for example, have a higher risk of developing atopic dermatitis,[4] are at an increased risk of developing certain cancers,[5–7] and have an increased risk of mortality from other diseases.[8]

Obesity is defined as the accumulation of excess adiposity and is one of the most common forms of malnutrition seen in otherwise well cared for domestic dogs and cats. Animals that are more than 20% over their ideal weight are considered obese[9] and published literature on canine and feline obesity prevalence indicate that between 34% and 63% of the dog and cat populations are either overweight or obese.[10–15]

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Excess adiposity in dogs and cats has a significant impact on the development of degenerative orthopedic disease,[16] insulin-resistance,[17] and diabetes mellitus.[11,12] It also impairs pulmonary function[18] and increases the risk of death from heat stroke in dogs.[19] Obese dogs and cats also have a higher prevalence of nonallergic skin disease[11,12,20,21] and lower urinary tract disease signs[11,12,22] compared with their lean cohorts (**Box 1**).

OBESITY AS A CHRONIC INFLAMMATORY CONDITION

Leptin, resistin, adiponectin, vascular endothelial growth factor, interleukin (IL)-6, and tumor necrosis factor (TNF)-α are among the adipose-derived cytokines (adipokines) and inflammatory mediators secreted by adipocytes. The elevated plasma concentrations of compounds, such as leptin, resistin, IL-6, and TNF-α, have been well documented in people[2] and have also been seen in obese dogs and cats.[23–32] Leptin is positively associated with body fat mass and increases or decreases with adiposity. Under normal homeostatic conditions leptin receptors on the hypothalamus provide feedback to the brain to control food intake, and subsequently body weight, within a specific metabolic range.[1] Obese dogs and cats have higher serum levels of leptin than lean counterparts.[23–32] Prolonged elevations in these adipokines either independently or in concert may set the stage for future metabolic derangement by inducing peripheral insulin resistance, propagating pain signaling, or altering circulating levels of serum lipids.[33]

Studies in obese dogs have also found higher levels of cortisol[28,29] and higher circulating levels of IL-6, TNF-α, and monocyte chemoattractant protein 1 concentrations relative to lean dogs.[26,27] IL-6 and TNF-α are proinflammatory mediators and are considered nonspecific markers of chronic inflammation; monocyte chemoattractant protein 1 promotes migration of inflammatory cells into a given area. This degree of constant low-grade inflammation has been theorized to result in altered immune function, but studies to this effect in dogs and cats have been limited. Obese puppies may have an increased risk of fatal complications from distemper virus.[34] Conversely, modest calorie restriction and maintenance of a lean body condition score (BCS) may slow age-related decline in immune cell function in dogs.[35] Dogs that maintained

Box 1
Health risks of obesity in dogs and cats

Known Heath Risks of Obesity	Species (Dog/Cat)	Reference
Increased risk/worsening of orthopedic disease	Dog/cat	16,88,89
Decreased overall activity	Dog	82,83
Increased risk of insulin resistance, diabetes mellitus	Dog/cat	11,12,17
Pulmonary dysfunction	Dog/cat	18
Increased risk of death from heat stroke	Dog	19
Increased risk nonallergic skin disease	Dog/cat	11,12,20,21
Increased risk lower urinary tract disease signs	Dog/cat	11,12,22
Altered intestinal flora	Dog/cat	29,45,46
Altered renal function, histologic changes to renal architecture	Dog	77–79
Hyperlipidemia	Dog/cat	26,28,42,49,50
Hepatic lipid accumulation	Dog/cat	53,56–58
Increased risk certain cancers	Dog	63–65,67,68
Decreased quality of life parameters (owner assessment)	Dog	86–89
Decreased life span	Dog	16,35