

OBESITY AND BARIATRIC SURGERY IN CANINES

Abstract:

Canine obesity is a common problem in some breeds. Traditional treatment method includes diet restriction, exercise and medication. Minimal invasive laparoscopic bariatric surgeries are trending in humans for the long-term management of obesity. Veterinarians are also turning towards these techniques in [managing](#) severely obese dogs. Bariatric surgical options are numerous and continue to expand with advancing technology due to the availability of less invasive procedures. Dedicated trials and research on this horizon will surely enlighten the path to the adoption of these techniques in the veterinary field. This chapter includes various aspects of obesity development in canines and different bariatric procedures in detail.

Keywords: Bariatric, Canine, Surgery, Obesity

Introduction

Obesity is one of the burning issues in pet health management [1]. Similar to human obesity rates, canine obesity rates have reached epidemic proportions, with 30% to 40% of dogs falling into the overweight to obese category [2]. Being overweight is an abnormal and excess fat accumulation in different body parts [3]. Canine obesity has been linked to various health issues, including osteoarthritis, renal illness, skin disease, insulin resistance, and neoplasia. Canine obesity has been widely documented in different parts of the world.

Obesity and overweight affect over half of all pet animals. Effective and team-based consultation is essential for [creating](#) an effective weight loss programme [4]. The diet should meet all necessary nutrient requirements during energy control. There are many ways to initiate a weight loss. [But](#) [However](#) regular intensive care is essential to obtain good outcomes.

Body mass index (BMI) is the way [for measurement of to measure](#) health status in canines [5]. Dogs with more than 25 BMI needs special attention to prevent consequences [6]. Body condition score (BCS) is another [method for assessing the canine body canine body assessment method](#) [7]. Dogs can be evaluated for BCS on a five-scale base. Three is considered ideal, and below and above three are considered underweight or overweight, respectively.

Obesity in India and abroad is reported at 26% and 40% [8]. Labrador, Golden retriever, boxer, pomeranian, dachshunds, cocker spaniels, pug, beagle and rottweiler are the common breeds predisposed to develop obesity [9]. Certain animal factors like age, gender, neutering, long-term medication and genetic diversity play a role in the development of obesity [10]. On the other hand, socio-economic status, environment, physical inactivity, and diet are the human factors responsible for this [11,12]. Neutered female dogs aged between 8-12 years of age are more prone to obesity [13]. Dogs whose owners are male, aged between 40 to 60 years, with passive and unusual lifestyles are more likely to develop obesity than others. The owner's income, exercise, and occupation also have an impact on the health of the dog [12].

Pathophysiology

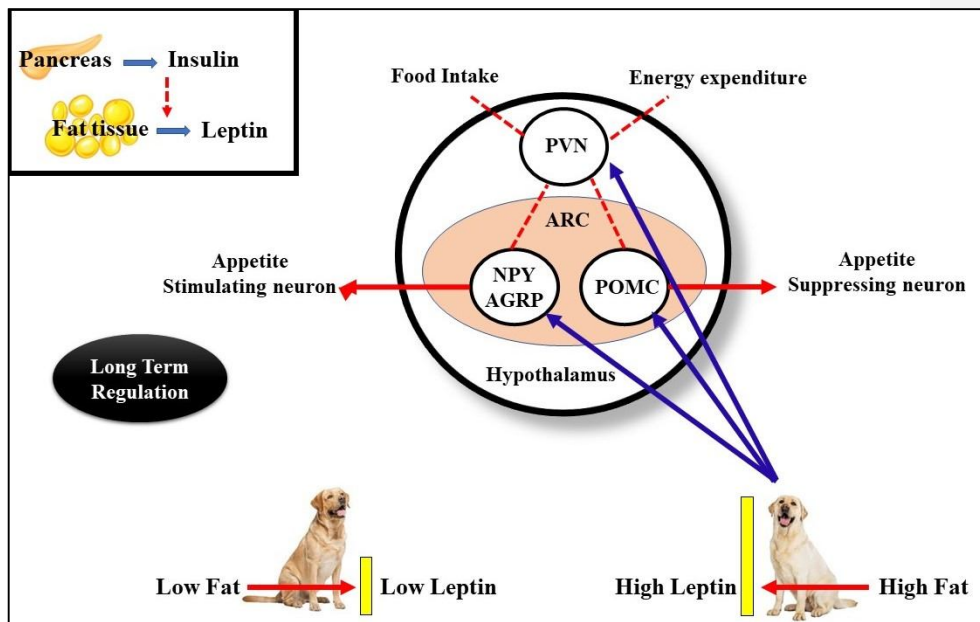


Figure 2. Long-term regulation of Hunger(Source: Dr Ankit S. Prajapati)

Obesity in dogs can be controlled by proper and adequate diet, exercise and medication in severe conditions. Calorie restriction, small-frequent meals, a diet with high protein, essential amino acids, fibre, and moisture content diet, and the inclusion of omega 3 & 6 fatty acids are efficient ways of controlling obesity.

A novel class of medications known as selective microsomal triglyceride transfer protein (MTP) inhibitors has its first FDA-approved product in dirlotapide. These substances prevent lipoproteins from assembling and releasing into the bloodstream. Though the exact cause of the weight loss linked to dirlotapide is unknown, it is believed to be the combination of decreased fat absorption and a satiety signal from lipid-filled intestinal lining cells [16]. Dirlotapide is administered as an oral solution once daily at 0.5 mg/kg body weight and 0.01 mg/kg body weight on the 14th day. Following that, the dose can be adjusted according to body weight loss. The most common side effects in dogs are vomiting, loose stools, diarrhoea, lethargy, anorexia, and elevated serum transaminase levels. Dirlotapide has been used in dogs with negligible side effects [2,17]. Dogs that do not follow their prescribed diet, exercise regimen, or medication are treated with bariatric surgery.

Bariatric Surgery

Bariatric surgery is a medical term for surgical procedures used to manage obesity and obesity-related conditions [18]. Canines are more prone to obesity, and the consequences are sometimes fatal. When medication fails to manage obesity, bariatric surgery is the only available option for the extension of canine life. Bariatric surgeries are also called weight loss surgeries or metabolic surgeries. Stomach of dogs and humans have almost similar physiology, so we can consider the human data valid for the dogs as well [19]. Bariatric surgery can be classified into three types: 1) Restrictive (Sleeve gastrectomy, gastric banding,

gastric plication, gastric banding); 2) Malabsorptive (Biliopancreatic diversion with duodenal switch); and 3) Hybrid (Gastric plication). Restrictive methods induce weight loss by limiting caloric intake; malabsorptive surgery works by decreasing intestinal caloric and nutrient absorption, whereas hybrid surgery is a combination of both. All bariatric procedures are minimally invasive techniques and can be performed by laparoscopic method[20].

Sleeve Gastrectomy

Sleeve gastrectomy is theirreversible removal of a 2/3rd portion of the stomach, including the fundus (Figure 3). The fundus secretes ghrelinand is responsible for hunger, which is reduced by removal. When the dog takes a small amount of food, the stomach becomes full,and the dog feels satiety and takes less food. A stapling device removes the vertical sleeve. By altering the anatomy of the GI tract, sleeve gastrectomy changes the signal to the body and reduces hunger.

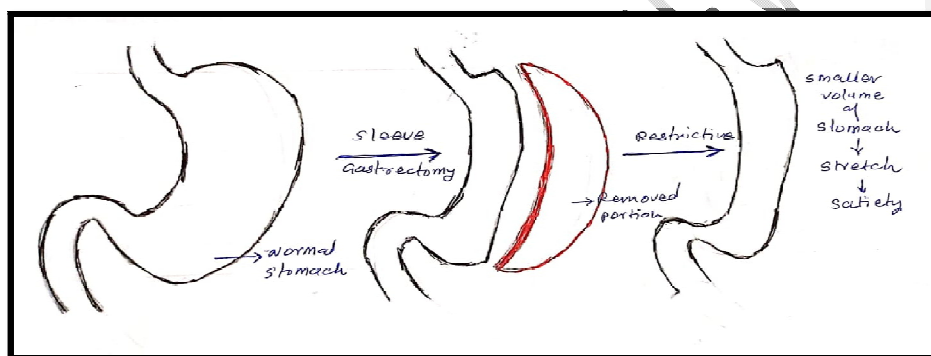


Figure 3. Sleeve gastrectomy procedure (Source: Dr Ankit S. Prajapati)

Gastric Banding (Lap Band Surgery)

A gastric banding procedure can be done by placing an adjustable silicon band at the upper part of the stomach, which divides the stomach into an upper smaller part and a lower larger portion(Figure 4). Band size can be adjusted by port from outside depending upon weight. When a canine ingests a small amount of food, it gives satiety and reduces further food intake. The advantage of this method is no cutting or stapling of the stomach, and it is reversible. In some cases, slipping of the gastric band can occur, leading to further complications.

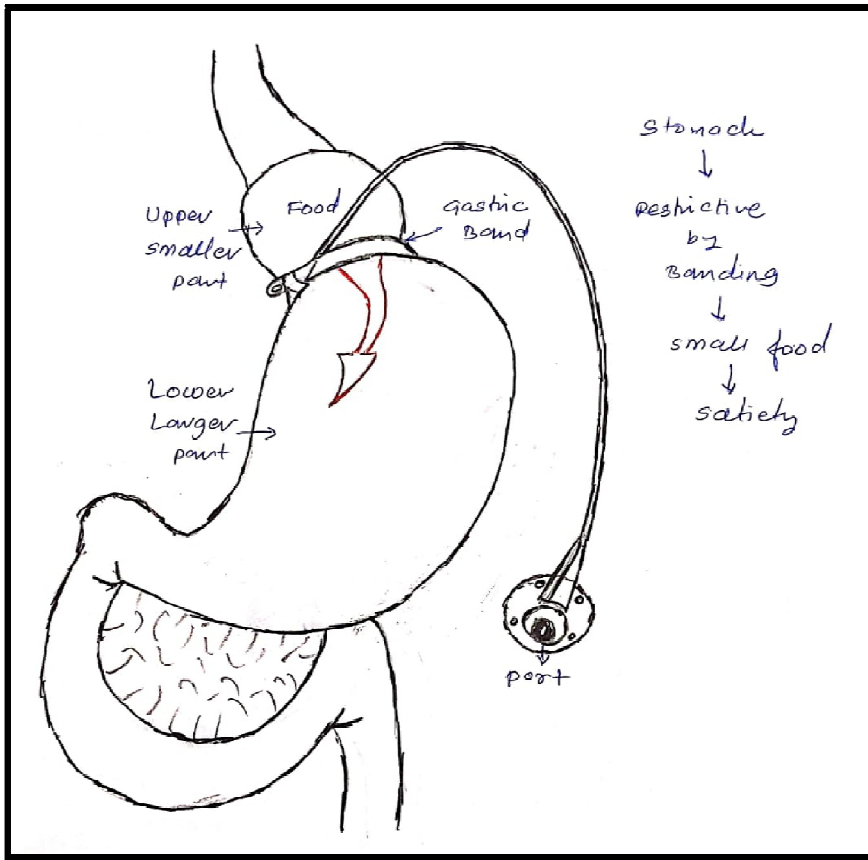


Figure 4. Gastric banding (Source: Dr Ankit S. Prajapati)

Gastric Plication

Gastric plication is ~~the~~ a bariatric procedure done to reduce stomach size by inverting the stomach either from large curvature or small curvature [21]. Large curvature is commonly preferred for this technique. In this method, double-fold serosa-to-serosa sutures are taken to reduce the stomach size (Figure 5). Tripathi et al. [22] conducted a trial on 15 dogs. They observed 20% weight reduction in 6 months and concluded that Laparoscopic gastric curvature serosa to serosa plication is a safe and effective technique in managing the weight of obese dogs. A similar study was also documented by Menchaca et al. [23], concluding that serosa-to-serosa apposition is safe and durable and is one of the adopted ways of weight loss. Thirty-eight hound dogs were used in this study.

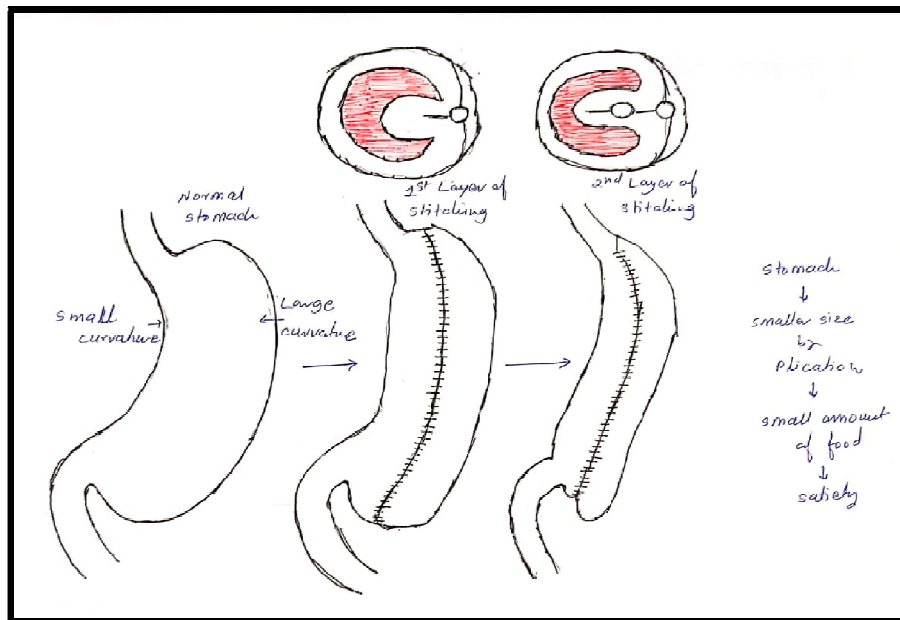


Figure 5. Gastric plication (Source: Dr Ankit S. Prajapati)

Biliopancreatic diversion with duodenal switch

This technique helps reduce weight by passing the food from the stomach, resulting in less caloric and nutrient absorption. This procedure begins with removing a large part of the stomach that releases food to the small intestine, along with the first part of the small intestine called the duodenum. The duodenum is separated from the upper part and directly attached to the end portion of the intestine, allowing bile and pancreatic enzymes to flow into this part of the intestine (Figure 6). This is known as biliopancreatic diversion; as a result of these changes, food bypasses the majority of the small intestine, limiting caloric and nutrient absorption while also reducing stomach size, resulting in weight loss.

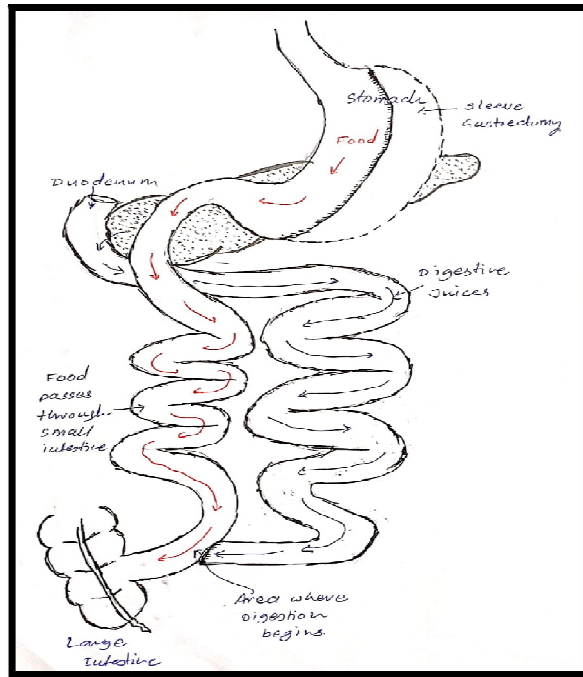


Figure 6. Biliopancreatic diversion with duodenal switch(Source: Dr Ankit S. Prajapati)

Roux-en-Y-gastric bypass (RYBG)

A small pouch is created from the stomach and attached directly to the small intestine in a weight-loss procedure known as gastric bypass, also known as Roux-en-Y (roo-en-wy) gastric bypass(Figure 7). After a gastric bypass, food that has been swallowed will pass through this tiny stomach pouch and [moves](#) straight into the small intestine, avoiding the majority of the stomach and the first part of the small intestine. Long-term patient monitoring is required after this surgery. Complications like dumping syndrome, bleeding, leakage, hernia and stricture of the digestive tract are likely to occur.

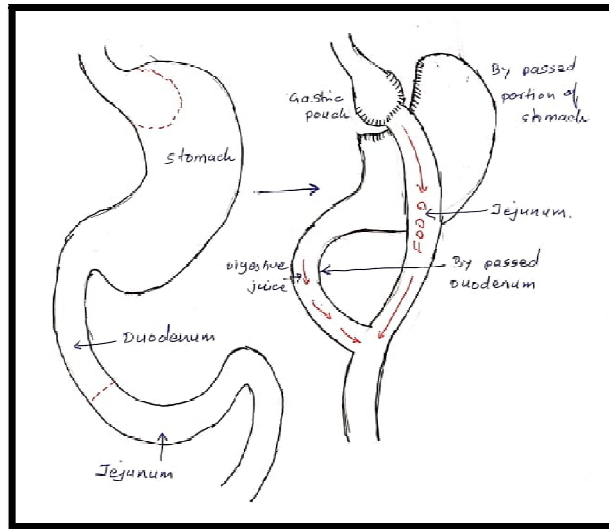


Figure 7. Roux-en-Y-gastric bypass (RYBG) (Source: Dr Ankit S. Prajapati)

In conclusion, Obesity is a burning issue in canines, especially labradors, pugs and golden retrievers belonging to well-to-do sedentary owners. Obesity is more prevalent in adult neutered female dogs with no exercise and *ad libitum* feeding habits. Obesity can be managed by caloric restriction, high protein, low fat, and other diet control strategies, such as exercise and medicine. Minimal invasive sleeve gastrectomy and gastric plication have been used successfully in canines.

Formatted: Font: Italic

Formatted: Font: Italic

References

1. Loftus JP, Wakshlag JJ. Canine and feline obesity: a review of pathophysiology, epidemiology, and clinical management. *Veterinary medicine (Auckland, N.Z.)*. 2014; 6: 49–60.
2. Gossellin J, Wren JA, Sunderland SJ. Canine obesity: an overview. *Journal of veterinary pharmacology and therapeutics*. 2007; 30(1): 1–10.
3. Wang Y, Beydoun MA, Liang L, Caballero B, Kumanyika SK. Will all Americans become overweight or obese? estimating the progression and cost of the US obesity epidemic. *Obesity (Silver Spring, Md.)*. 2008; 16(10): 2323–2330.
4. Flanagan J, Bissot T, Hours MA, Moreno B, Feugier A, German AJ. Success of a weight loss plan for overweight dogs: The results of an international weight loss study. 2017; *PloS one*, 12(9): e0184199.
5. Linder DE, Santiago S, Halbreich ED. Is There a Correlation Between Dog Obesity and Human Obesity? Preliminary Findings of Overweight Status Among Dog Owners and Their Dogs. *Frontiers in veterinary science*. 2021; 8: 654617.
6. Nijland ML, Stam F, Seidell JC. Overweight in dogs, but not in cats, is related to overweight in their owners. *Public health nutrition*. 2010; 13(1): 102–106.

7. Chun JL, Bang HT, Ji SY, Jeong JY, Kim M, Kim B, Lee SD, Lee YK, Reddy KE, Kim KH. A simple method to evaluate body condition score to maintain the optimal body weight in dogs. *Journal of animal science and technology*. 2019; 61(6): 366–370.
8. Endenburg N, Soontarak S, Charoensuk C, van Lith HA. Quality of life and owner attitude to dog overweight and obesity in Thailand and the Netherlands. *BMC veterinary research*. 2018; 14(1): 221.
9. Pegram C, Raffan E, White E, Ashworth AH, Brodbelt DC, Church DB, O'Neill DG. Frequency, breed predisposition and demographic risk factors for overweight status in dogs in the UK. *The Journal of small animal practice*. 2021; 62(7): 521–530.
10. Courcier EA, Thomson RM, Mellor DJ, Yam PS. An epidemiological study of environmental factors associated with canine obesity. *The Journal of small animal practice*. 2010; 51(7): 362–367.
11. Orsolya JT, Kata V, Vanda Katalin J, Péter P. Factors Affecting Canine Obesity Seem to Be Independent of the Economic Status of the Country-A Survey on Hungarian Companion Dogs. *Animals: an open access journal from MDPI*. 2020; 10(8): 1267.
12. Suarez L, Bautista-Castaño I, Peña Romera C, Montoya-Alonso JA, Corbera JA. Is Dog Owner Obesity a Risk Factor for Canine Obesity? A "One-Health" Study on Human-Animal Interaction in a Region with a High Prevalence of Obesity. *Veterinary sciences*. 2022; 9(5): 243.
13. Vendramini THA, Gomes Olivindo RF, Zafalon RVA, Rentas MF, Zanini LD, Amaral AR, Pedrinelli V, de Oliveira VV, Risolia LW, Teixeira FA, Brunetto MA. Profile qualitative variables on the dynamics of weight loss programs in dogs. *PloS one*. 2022; 17(1): e0261946.
14. Yeung AY, Tadi P. Physiology, Obesity Neurohormonal Appetite and Satiety Control. In *StatPearls*. StatPearls Publishing. 2023.
15. Daminet S, Jeusette I, Duchateau L, Diez M, Van de Maele I, De Rick A. Evaluation of thyroid function in obese dogs and in dogs undergoing a weight loss protocol. *Journal of veterinary medicine. A, Physiology, pathology, clinical medicine*. 2003; 50(4): 213–218.
16. Klonoff DC. Dirlotapide, a U.S. Food and Drug Administration-approved first-in-class obesity drug for dogs-will humans be next?. *Journal of diabetes science and technology*. 2007; 1(3): 314–316.
17. Wren JA, King VL, Krautmann MJ, Gossellin J, Kerlin RL, Hickman MA, Schmahl TJ. The safety of dirlotapide in dogs. *Journal of veterinary pharmacology and therapeutics*. 2007; 30 Suppl 1: 43–54.
18. Schroeder R, Harrison TD, McGraw SL. Treatment of Adult Obesity with Bariatric Surgery. *American family physician*. 2016; 93(1): 31–37.
19. Kararli TT. Comparison of the gastrointestinal anatomy, physiology, and biochemistry of humans and commonly used laboratory animals. *Biopharmaceutics & drug disposition*. 1995; 16(5): 351–380.

20. Rashti F, Gupta E, Ebrahimi S, Shope TR, Koch TR, Gostout CJ. Development of minimally invasive techniques for management of medically-complicated obesity. *World journal of gastroenterology*. 2014; 20(37): 13424–13445.
21. Albanese A, Prevedello L, Verdi D, Nitti D, Vettor R, Foletto M. Laparoscopic Gastric Plication: An Emerging Bariatric Procedure with High Surgical Revision Rate. *Bariatric surgical practice and patient care*. 2015; 10(3): 93–98.
22. Tripathi SD, Sarkate LB, Lokhande DU, Khandekar GS, Dalvi SH. Clinical evaluation of laparoscopic gastric greater curvature serosa to serosa plication for weight management in obese dogs. *Indian Journal of Veterinary Surgery*. 2019; 40(2): 93-97.
23. Menchaca HJ, Harris JL, Thompson SE, Mootoo M, Michalek VN, Buchwald H. Gastric plication: preclinical study of durability of serosa-to-serosa apposition. *Surgery for obesity and related diseases: official journal of the American Society for Bariatric Surgery*. 2011; 7(1): 8–14.