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Comparison of Sleeve Gastrectomy on Body Weight, Blood Glucose and Concentration of hormones in Blood Plasma (Insulin ng/ml) in Castrated, Non-Castrated Obese Dogs

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A B S T R A C T

Obesity adds a significant burden to obese dogs, as well as the veterinary health-care systems. Bariatric surgery is the most effective treatment for severe obesity and its comorbidities. Twenty four obese dogs (8 controlled, 8 castrated, 8 non-castrated) were recruited into the study. The aim of this study was to evaluate sleeve gastrectomy as bariatric intervention in groups under study by estimating body weight and evaluating blood glucose and insulin levels in castrated, non-castrated obese dogs. Postoperatively, we evaluated the body weight in the groups and estimated the blood glucose and insulin levels in the castrated, non-castrated obese dogs at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 weeks after the operation. After sleeve gastrectomy, the average body weight in control, castrated obese dogs was higher than non-castrated obese dogs with a significant difference at a significant level (.05). Post operation, the average blood glucose and insulin level in the blood are higher in castrated obese dogs than in non-castrated obese dogs, with statistically significant differences at a significant level (.05). After the operation, we observed a general decrease in the average body weight, blood glucose and insulin levels in the groups with a clear increase in the average body weight, blood glucose and insulin levels in castrated obese dogs than in non-castrated obese dogs.

Keywords

Obesity, sleeve gastrectomy, castration, body weight, glucose, insulin

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Introduction

Obesity is the most common medical disease in dogs (German, 2006). Overweight and obesity have reached epidemic rates today and represent a major health problem in human and veterinary medicine. Recent studies have shown that between 40 % - 55 % of dogs are overweight, with a continuous upward trend (Switonski and Mankowska, 2013; De Godoy and Swanson, 2013).Castration in male dogs is the most common small animal surgery performed in some countries and is unethical or illegal in other

countries (Salmeri *et al.,* 1991b). Bariatric surgery (weight-loss surgery) includes a variety of procedures performed on dogs which are obese (Rai *et al.,* 2014). Sleeve gastrectomy has been introduced as a multi-purpose bariatric operation (Baltasar *et al.,* 2005). Sleeve gastrectomy involves resection of the greater curvature of the stomach and preservation of the pyloric valve and gastro esophageal junction (Langer *et al.,* 2005 and Melissas *et al.,* 2008).

Glucose is a monosaccharide, which is used by the body as an energy source and as a precursor in the production of lipids and proteins. Glucose is used as the prime energy source in most cells (Johnson, 2008). Insulin is an anabolic hormone that is secreted from β-cells in the pancreas under stimulation of glucose in the blood stream. The presence and binding of insulin mediates the incorporation of glucose transporters into the cell surface and glucose is then eliminated from the blood (Frayn, 2009).

Material and Methods

Animal management and preparation

This study was conducted at the College of Veterinary Medicine at Sudan University of Science and Technology. A total of 24 male dogs were purchased from the market. Experiment animals were placed in separate cages at room temperature, natural light conditions and given a high-protein, high-fat diet with free access to water. The dogs were fed a high-calorie diet for three months, which was enough time to get obese dogs. The diet consisted of a standard diet with the inclusion of butter and animal fat (fat made up 20% of the diet). 12-month-old dogs (25 kg b w) were weighed. Experimental animals are handled and monitored using the lane and Cooper method (2003) and they are divided into three groups (8 control, 8 castrated and 8 non-castrated obese dogs). The site of the operation was shaved and disinfected with alcohol, the injection site of anesthesia prepared by sterilization technique.

Technique

On the day of surgery, the surgeon's hands and arms were scrubbed using a brush and disinfectant soap. After that, they wear the surgeon's set (cap, mask and surgical gown). After a 12-h overnight fast, obese dogs were pre-medicated with intramuscular injections of xylazine 1mg/kg and Ketamine 10mg/kg used as general anesthesia (İlker *et al.*, 2013). All surgical procedures were performed under sterile conditions. The animal laid down in a supine position. The abdomen washed thoroughly, sterile skin preparation with povidone iodine (Al-Wadani *et al.,* 2017). A 10-cm linea ulba midline incision was made. Subcutaneous fat is a substantial hurdle in weight-loss surgery. The first step of the procedure is the division of the vascular supply into the greater curvature of the stomach. It is followed by longitudinal gastrectomy, which " sleeves" the stomach to reduce it to a narrow tube. In this fashion, gastric continuity was maintained and the greater curvature region of the stomach eliminated. The transacted stomach, which includes the greater curvature, has been completely removed. Up to 70 – 80% of the stomach was removed without any major loss of organ function. The stomach (5 cm in diameter) is sutured back together in layers, using cut gut. Non-absorbable sutures close the skin incision. The dogs were followed up after the operation until proper healing. Painkillers are administered (*Flunxicin melgeomine*). Following surgery, food and water restrictions were implemented while dogs received Ringer-Lactate solution for three days subsequent with the balanced soft and/or syrupy diet supplemented with minerals and vitamins. Postoperatively, we estimated the body weight of the groups under study and blood samples were collected from the cephalic vein of obese dogs and collected into heparinized plastic tubes. Plasma was recovered by centrifugation at 1500g for 10 min at 4°C and subsequently stored at −25°C, blood glucose measured (mg/dl) and concentration of hormones in blood plasma Insulin (ng/ml) in castrated non-castrated obese dogs on 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 weeks after operation.

Statistical analysis

The data concerning the body weight from all the studied groups were subjected to one-way analysis of variance (ANOVA). The independent t- test was used for comparison of blood glucose and insulin levels in castrated, non-castrated obese dogs after an operation. The results were considered statistically significant at $p \leq 0.05$.

Results and Discussion

In order to answer one of the hypotheses of the study, which states that there are statistically significant differences in body weight after sleeve gastrectomy, which is due to the castration variable among the obese dogs under study. To examine this question, a one-way analysis was conducted to discover whether there are statistically significant differences in body weight after gastric sleeve gastrectomy in obese dogs for the sample under study according to the castrating variable.

Table No. (1) shows the results of the one-way analysis of variance and from it we conclude that there are statistically significant differences in the body weight of obese dogs according to the castration variable, where the values of (F) 118,663 came with a probability value of .000 less than 0.05 as a statistical function. The previous table also shows a higher mean value of castrated obese dogs than non-castrated obese dogs. Chart No. 1 illustrates these results.

We can also see from Table No. (2) the average blood glucose in castrated obese dogs after an operation is (93.6589) mg/dl with a standard deviation of (6.44928). Average blood glucose level represented a significant decrease in non-castrated obese dogs compared to castrated obese dogs, so that equals in non-castrated obese dogs (89.4000) mg/dl with a standard deviation of (4.53241) with a probability value (.000) is less than the significance level (.05). Statistically significant differences were found in average blood glucose between the two groups in favor of obese castrated dogs higher in averages (Table 2). Chart No. 2 illustrates these results.

Plasma concentrations of hormone insulin(ng/ml) are summarized in table no. (2) We see that the average Insulin in castrated obese dogs after an operation is (125.0357) ng/dl with a standard deviation of (25.86190) which is higher than the average Insulin in non-castrated obese dogs which is equal to (113.1098) ng/dl with a standard deviation of (21.59499) with a probability value (.054) is equal to the significance level (.05), and accordingly we decide that there are statistically significant differences at the significance level (.05) between the average Insulin in castrated and non-castrated obese dogs in favor of castrated obese dogs higher in averages. Chart No. 3 illustrates these results.

The surgical treatment for obesity must be safe and effective. Therefore, the ideal operation must have minimal risks of short- and long-term morbidity and mortality, produce significant and durable weight loss, and maintain normal gastrointestinal function (Iannelli *et al.*, 2008; Maclean *et al.*, 1993; Silecchia *et al.*, 2006; Cottam *et al.*, 2006). In the present study, sleeve gastrectomy is designed to create a partial narrow gastric tube that reduces gastric capacity and induces an early sensation of satiety that leads to diminished food intake. We chose a canine model as our experimental subject, since there are physiological and anatomical similarities between the foreguts of dogs and humans. After the operation, the castrated, non-castrated obese dogs achieved a significant decrease in food intake. Postoperatively, we estimated a decrease in the average body weight of non-castrated obese dogs.

Table.1 Shows the results of the body weight in the groups and the statistical significance.

Groups	mean	Std. Deviation	F	Sig	Statistical significance
Group a	20.6437	.80826	118.663	.000	**<.05**
Group b	14.3000	1.75458			
Group c	13.4000	1.85531			

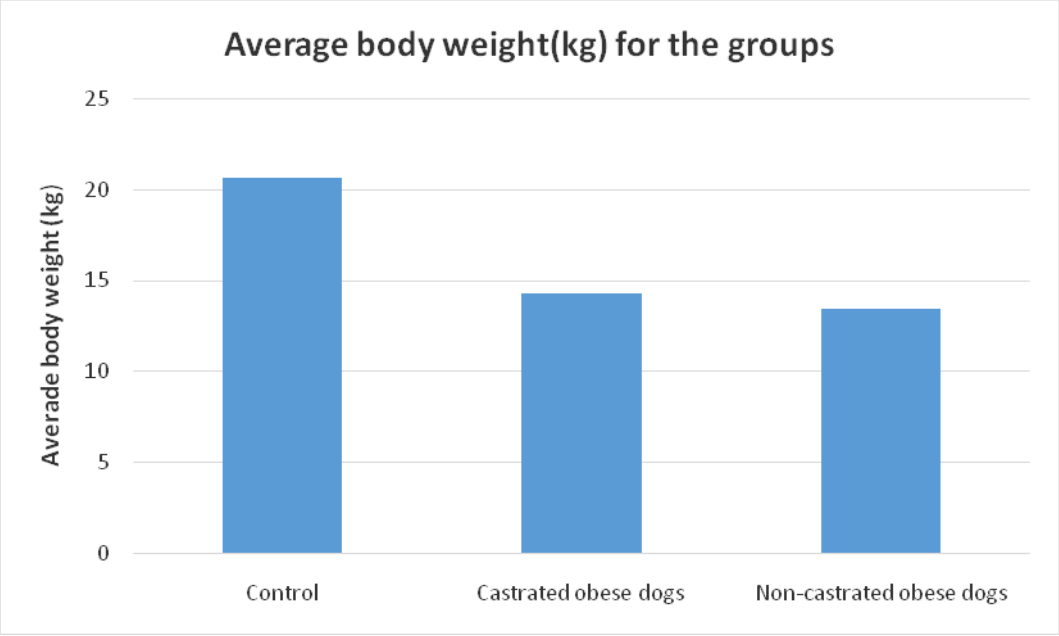
*groups (a, b and c). *group a: control. *group b: castrated obese dogs. *group c: non-castrated obese dogs. *Statistical significance p≤ .05

Table.2 T-test results for the difference between average blood glucose (mg/dl) and Concentration of hormones in blood plasma Insulin (ng/ml) according to the two groups.

	Group	N	Mean	Std. Deviation	T value	Sig	Statistical significance
BG (mg/dl)	Group A	112	93.6589	6.44928	5.718	.000	**Statistically significant**
	Group B	112	89.4000	4.53241			
Insulin (ng/ml)	Group A	112	125.0357	25.86190	3.746	.054	**Statistically significant**

*group A: castrated dog. *group B: non-castrated dogs. *BG: blood glucose. *Statistical significance p≤.05.

Chart.1 Average body weigh t(kg) for the groups.



*Groups (Control, Castrated obese dogs, Non-castrated obese dogs).

Chart.2 Average blood glucose (mg/dl) in castrated, non-castrated obese dogs

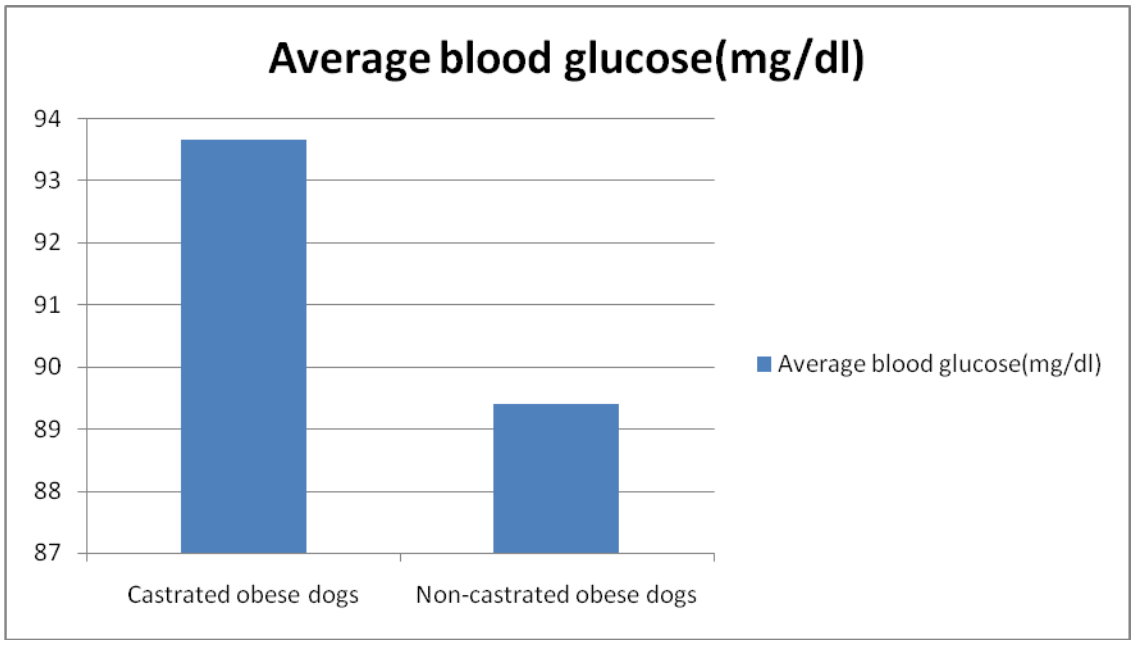
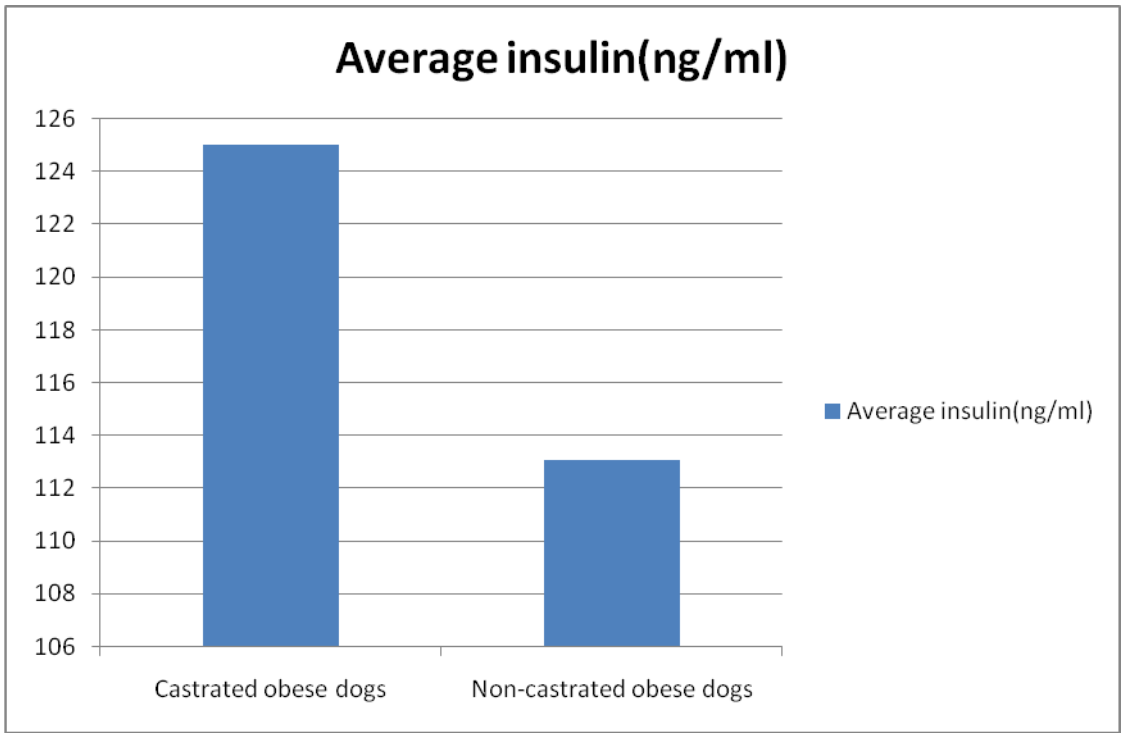


Chart.3 Average insulin (ng/ml) in castrated, non-castrated obese dogs



A decrease in the average body weight of non-castrated obese dogs was observed (Hamoui *et al.,* 2006; tuker *et al.,* 2008; Klok *et al.,* 2007). The current study found a decrease in average body weight in castrated obese dogs. Our results agree with those published by Diamantis *et al.,* (2014); Runkel *et al.,* (2011); Carlin *et al.,* (2013). In this study, from table no (1), the average body weight of controlled and castrated obese dogs was reported to be higher compared to the average body weight of obese non-castrated dogs, with significant differences. These results are agreed with (Gossellin *et al.,* 2007; Colliard *et al.,* 2006; Lund *et al.,* 2006). This study found significant decrease in average blood glucose in non-castrated obese dogs, as has been described in human surgery in obese patients (Gill et al., 2010).

The results of this study showed a decrease in average blood glucose in castrated dogs; these results were shown by previous studies (Brehm *et al.,* 2004; Mclaughlin *et al.,* 2005). From the result, there was a statistically significant difference (.05) between the average blood glucose in castrated and non-castrated obese dogs in favor of obese castrated dogs, higher on average. These results are shown by (Root *et al.,* 1996; Verkest *et al.,* 2011; Harber *et al.,* 2001; Flynn *et al.,* 1996; Hoening and Ferguson, 2002). On the other hand, the castrated obese dogs cohort studied in this thesis showed decreased average insulin after an operation. These results are consistent with those recently obtained by (Tvarijonaviciute *et al.,* 2016; Tvarijonaviciute *et al.,* 2012). From the results, a decrease in insulin levels in non-castrated obese dogs. These results were obtained by RC de Godoy et al (2015). In this study, a decrease in the average insulin levels was observed in castrated obese dogs, but it was higher than the average insulin levels in non-castrated obese dogs. These results were agreed with (José Lahm Cardoso *et al.,* 2016; Angela *et al.,* 2008; Martin *et al.,* 2006).

This study set out to compare body weight, glucose and insulin in groups under study after sleeve gastrectomy. This study has shown that a significant decrease in body weight postoperatively. The research has also shown that a reduce in glucose and insulin levels in castrated, non-castrated obese dogs. The results of this study indicate that the average body weight, glucose and insulin in castrated obese dogs are higher than non-castrated obese dogs.

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