



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(7): 139-142
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www.thepharmajournal.com
Received: 24-05-2022
Accepted: 30-06-2022

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Haematological parameters changes in canine obesity

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Abstract

The current study aimed to evaluate the haematological parameters changes in obese dogs. A total of 210 adult dogs irrespective of age, sex and breed were screened for obesity. The adult dogs weighing more than 15 per cent of their ideal body weight were considered for the study and body condition score was assigned as whole number value 1 to 9 and dogs with BCS 8 to 9 were considered as obese. Eighteen obese dogs were undertaken for the present study for haematological parameters estimation. Six apparently healthy dogs excluded from the obesity base on selection criteria were also be taken as control for this study. The haematological parameters *viz.* Hb, TEC, PCV, TLC, neutrophils, were significantly higher in obese dogs whereas non-significant difference was found in lymphocytes, monocytes, eosinophils, in obese dogs as compared to apparently healthy dogs.

Keywords: Obesity, body condition score, haematology

1. Introduction

Obesity is now a major worldwide non-communicable medical condition of humans and companion animals where the accumulation of excess body fat adversely affects the health of both (Kopelman, 2000) [11]. Obesity has become an emerging challenge at global level to the practicing veterinarians and pet-owners which requires newer methods of diagnosis and treatment approaches for its effective control. Obesity is not a disease itself, but a status of the body/clinical sign, which has various predisposing factors to develop and itself predisposes the animal to other non-specific disorders (Shah *et al.*, 2017) [25]. Obesity be defined as 30% above ideal body weight. While excess body weight (overweight and obesity) represents a continuum and any cut-point for onset of disease is somewhat arbitrary. This definition correlates with the determination of obesity in humans using the standard metric such as body mass index (BMI) and abdominal circumference. It is also consistent and broadly supported by veterinary studies where there are associations with various co-morbid diseases, functional impairment, and decreased quality of life (Ward *et al.*, 2018) [30]. Body condition score system is a subjective and semi quantitative evaluation which based on some visible and palpable features of different zones. There is estimated the place and the dimension of adipose deposits, the visible and invisible structure of skeleton and of the silhouette of the animal. There were three types of body condition score 3 grades, 5 grades and 9 grades. Each half-grade above grade 3 represents an increase in weight of 10% (Czirjak and Chereji (2008) [6]. Body Condition Scoring, a method used by veterinarians to assess an animal's overall shape with regard to weight is considered to be an excellent method to determine an animal's overall body condition (Smith *et al.*, 2018) [27]. Body condition score significantly associate with dog age. The height prevalence of dog become overweight or obese between 7.5–9.9 years (71%) Holmes *et al.*, 2007) [9]. The certain breeds of dogs were more likely to be overweight (Labrador/Cocker Spaniel / Dalmatians / Dachshund / Rottweiler / Golden Retriever / Shetland Sheepdog / Mixed breed) and more likely to be obese (Labrador/Dachshund/Golden retriever) (Lund *et al.* (2006) [15]. The improper feeding frequency and diet selection, ad-libitum feeding, supplementation, feeding homemade meals and feeding behavior led to excess calorie consumption. Begging, competitive eating with other pets and specific food addictions are problems in some homes and are identifiable risk factors (Crane, 1991) [7]. Obese dogs are more likely to suffer from osteoarticular disorders, heart problems, respiratory problems or skin disease. Obese dogs' owners do not have sufficient knowledge regarding treatment of obesity. The main preventive measures are daily exercise and providing the dog with correct food amount (Antoniu, 2018) [2]. Obese dogs were insulin resistant because serum insulin and insulin/ glucose ratios were higher than in lean dogs and he also revealed that mean value of

cholesterol, and triglycerides were significantly higher in the obese dogs. Obesity as an important predisposing factor for type 2 diabetes mellitus and the vast majority of obese dogs were insulin resistant. The increase of insulin secretion and impairment of its action leads to an alteration in energy metabolism and contributes to chronic hyperglycemia (Polonsky, 2000) [21]. The risk factors associated with obesity prevention and early detection of obesity leads to better health care. Many owners do not know if the dog is obese, or do not know why it is dangerous. One way to prevent obesity may therefore be to increase the owners' awareness and knowledge about obesity and how the dog is kept at normal body condition.

2. Materials and Methods

2.1 Selection of Animals

The present study entitled was conducted on adult dogs presented for routine clinical examination/ vaccination in canine out-door of Veterinary Clinical Complex, College of Veterinary and Animal Science, Bikaner, Rajasthan, India. Dogs were considered as obese when body weight excess optimum weight for body size by fifteen per-cent (Simpson *et al.*, 1993; Laflamme, 2001). [26, 13] Body condition score were assigned as whole number value 1 to 9 at the time of visual examination and palpation system (Laflamme, 1990; Burkholder and Toll, 2000) [12, 5]. Four classes of BCS were considered: BCS 1 to 3 (Lean dogs), BCS 4 to 5 (ideal dogs), BCS 6 to 7 (overweight dogs) and BCS 8 to 9 (obese dogs) (Ricci *et al.*, 2007) [23]. In present study dogs with BCS 8 to 9 were considered as obese. A total of 210 adult dogs irrespective of age, sex and breed were screened for obesity. The adult dogs weighing more than 15 per cent of their ideal body weight were considered for the study and body condition score was assigned as whole number value 1 to 9 and dogs with BCS 8 to 9 were considered as obese. Eighteen obese dogs were undertaken for the present study for haematological parameters estimation. Six apparently healthy dogs excluded from the obesity base on selection criteria were also be taken as control for this study.

2.2 Collection of blood samples

After clinical examination of obese dogs, 5.0 ml of blood sample were collected aseptically in sterile syringe from cephalic vein and out of which, 2.0 ml blood was transfer aseptically in EDTA vacutainer for haematological analysis

2.3 Haematological examinations

The blood samples were subjected for estimation of some of the haematological parameters *viz.* haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC). These parameters were analysed as per standard haematological methods cited by Schalm's veterinary haematology (Jain, 1986) [10].

2.4 Statistical analysis

The data obtained in the present research work was statistically analyzed and compared using standard formulas given for mean, standard error, one way analysis of variance (ANOVA) and t- test as per the procedures explained by Snedecor and Cochran (2004) [28].

3. Results and Discussion

3.1 Haematological parameters

The Mean \pm SE values of haematological parameters of obese dogs and apparently healthy dogs are presented in Table 4 and depicted in Figure 8.

Table 1: Mean \pm SE values of haematological parameters of obese dogs and apparently healthy dogs

S. No.	Parameters	Obese dogs (n=18)	Healthy dogs (n=6)	Statistical analysis (T test)
1	Hb (g/dl)	15.23 \pm 0.54	11.98 \pm 0.68	**
2	TEC ($\times 10^6/\mu$ l)	7.17 \pm 0.20	5.58 \pm 0.12	**
3	PCV (%)	46.42 \pm 1.50	33.67 \pm 1.58	**
4	TLC ($\times 10^3/\mu$ l)	12.63 \pm 0.47	9.40 \pm 0.29	**
5	DLC			
5.1	N (%)	82.33 \pm 0.71	77.83 \pm 0.98	*
5.2	L (%)	14.00 \pm 0.67	18.50 \pm 0.84	NS
5.3	M (%)	2.22 \pm 0.19	2.33 \pm 0.21	NS
5.4	E (%)	1.44 \pm 0.16	1.33 \pm 0.33	NS

The asterisk (*) indicate significant ($p < 0.05$) difference, (**) indicate highly significant ($p < 0.01$) difference and NS indicate Non significant ($p > 0.05$) difference

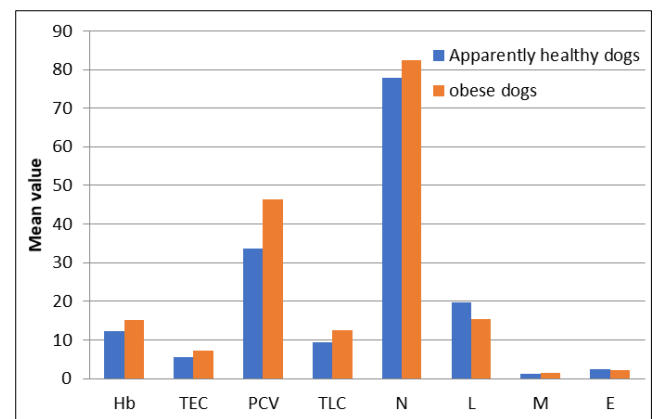


Fig 1: Mean values of haematological parameters of obese and apparently healthy dogs

The mean values of Hb (g/dl), TEC ($\times 10^6/\mu$ l), PCV (%) and TLC ($\times 10^3/\mu$ l) in obese dogs were 15.23 \pm 0.54, 7.17 \pm 0.20, 46.42 \pm 1.50 and 12.63 \pm 0.47, whereas, in apparently healthy dogs 11.98 \pm 0.68, 5.58 \pm 0.12, 33.66 \pm 1.58 and 9.40 \pm 0.29, respectively.

The mean values of Hb, TEC and PCV were significantly ($p < 0.01$) higher in obese dogs as compared to healthy dogs. Significantly higher mean value of Hb and TEC in our study were in agreement with Zhang *et al.* (2010), Ornelas *et al.* (2011), Vuong *et al.* (2014) and Gurupreet, (2019) [31, 19, 29, 8] who reported higher Hb and TEC in obese dogs as compared to healthy dogs but were in contrast to Nandini *et al.* (2012), Baric Rafaj *et al.* (2016) and Barbosa *et al.* (2019) [16, 4, 3] who reported no difference in Hb and TEC values in normal and obese dogs. The possible reason for increased haemoglobin values in obese dogs may be due to positive correlation between haemoglobin and BMI and negative correlation between haemoglobin and adiponectin. Dogs with high BMI have low circulating adiponectin and reduced insulin sensitivity and thus subsequently have poor glucose metabolic regulation that leads to increase in glycosylated haemoglobin level. This glycosylated haemoglobin has elevated affinity

towards oxygen and high level of glycosylated haemoglobin subsequently leads to tissue hypoxia, which in turn results in an increased in red cell count and haemoglobin level that eventuate from normal physiologic feedback (Low *et al.* 2008) [14].

The mean value of PCV in present study was in agreement with Nandini *et al.* (2012) and Gurupreet, (2019) [16, 8] who also found an increased level of PCV in obese dogs and the possible reason for increase in PCV could be increased sympathetic nerve stimulation leading to splenic contractions which forces the RBCs to move out into the blood circulation (Oystein *et al.* 2003) [20]. Another reason for increased PCV might be increase in the leptin levels in obesity which also causes sympathetic stimulation of nervous system (Nijima, 1998) [18]. Significant correlation has been reported between PCV, BMI and fat storage in obesity by Akinnuga *et al.* (2011) [1]. The mean values of TLC of obese dogs were found significantly ($p < 0.01$) higher when compare to mean values of apparently healthy dogs. This present finding is in accordance with the finding of Radakovich *et al.* (2017) [22] who found significantly higher mean value of TLC count in obese dogs than normal weight dogs.

The mean values of DLC (%) viz, neutrophils (%), lymphocytes (%), monocytes (%) and eosinophils (%) in obese dogs were 82.33 ± 0.71 , 114.00 ± 0.67 , 2.22 ± 0.19 and 1.44 ± 0.16 , whereas, in healthy dogs 77.83 ± 0.98 , 18.50 ± 0.84 , 2.33 ± 0.21 and 1.33 ± 0.33 , respectively. The mean value of neutrophils was significantly ($p < 0.05$) higher in obese dogs as compare with the mean value of neutrophils in apparently healthy dogs. Whereas, non significant difference in mean values of lymphocytes, monocytes and eosinophils were observed in obese dogs when compare with the mean value of these parameters in apparently healthy dogs in the present findings.

Similar findings were also reported by Baric Rafaj *et al.* (2016) [4] and Radakovich *et al.* (2017) [22] who found significantly higher value of neutrophils in obese dogs. This finding is also in agreement with the study by Ryder *et al.* (2014) [24], who found that neutrophils correlated positively with increased visceral fat in human. Higher mean value of neutrophils indicates the continuous activation of the immune system and chronic low grade inflammation associated with obesity in dogs (Baric Rafaj *et al.* 2016 and Radakovich *et al.* 2017) [4, 22].

4. Conclusions

The present study was conducted to evaluate haematological changes in dogs suffering with obesity. The haematological parameters revealed that the mean values of Hb, PCV TEC, TLC and neutrophils were significantly higher in obese dogs as compared to apparently healthy dogs whereas non significant difference was found in lymphocytes, monocytes and eosinophils in obese dogs.

5. Acknowledgements

The authors acknowledge the help and permission provided by the Head of Department of Veterinary Clinical Medicine, College of Veterinary and Animal science, Bikaner also the permission and help by the Dean, College of Veterinary and Animal science, Bikaner is thankfully acknowledged.

6. Conflict of interest

Authors are thankful to Dean, CVAS Bikaner for financial support and provided facility.

7. References

1. Akinnuga AM, Bamidele O, Chukwuebuka IC. Correlation between packed cell volume and body mass index in hypertensive and normotensive subjects. *Annals of Biological Research.* 2011;2(2):65-71.
2. Antoniou N. Analysis of dog obesity in Cyprus Paphos X small animal clinic. Master thesis submitted to Lithuanian University of Health Sciences, Kaunas, Lithuania, 2018.
3. Barbosa ADA, Martins NF, Rosario SA, Da Silva Nunes PC, Passarelli D, Leite-Dellova DCA. Evaluation of coagulation parameters in dogs with overweight or obesity. *Acta Scientiae Veterinariae.* 2019;47:1638.
4. Baric Rafaj R, Kules J, Turkovic V, Rebselj B, Mrljak V, Kucer N. Prospective hematological and biochemical evaluation of spontaneously overweight and obese dogs. *Veterinarski Arhiv.* 2016;86(3):383-394.
5. Burkholder W, Toll, P. Obesity: In Small Animal Clinical Nutrition. Mark Morris Institute, Topeka, 2000, 401-430.
6. Czirják TZ, Chereji, A. Canine Obesity-A major problem of pet dogs. *Fascicula: Ecotoxicologie, Zootehniesi Tehnologii de Industrie Alimentara.* 2008;7:361-366.
7. Crane SW. Occurrence and management of obesity in companion animals. *Journal of Small Animal Practice.* 1991;32(6):275-282.
8. Gurpreet. Risk factors and diagnosis of obesity in companion dogs. M.V.Sc Thesis submitted to Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, 2019.
9. Holmes KL, Morris PJ, Abdulla Z, Hackett R, Rawlings JM. Risk factors associated with excess body weight in dogs in the UK. *Journal of Animal Physiology and Animal Nutrition.* 2007;91(3-4):166-167.
10. Jain NC. *Schalms Veterinary Haematology.* 4th ed. Lea and Febiger, Philadelphia, USA, 1986, 1168.
11. Kopelman PG. Obesity as a medical problem. *Nature.* 2000;404(6778):635.
12. Laflamme D. Development and validation of a body condition score system for dogs. *Canine Practice.* 1997;22:10-15.
13. Laflamme DP. Challenges with weight-reduction studies. *Compendium on Continuing Education for the Practising Veterinarian.* 2001;23:45-50.
14. Low C, Tohit E, Chong P, Idris F. Adiponectin and hemoglobin levels in overweight and obese pregnant mothers in early pregnancy. *The Internet Journal of Gynecology and Obstetrics.* 2008;11(2):1-6.
15. Lund EM, Armstrong PJ, Kirk CA, Klausner JS. Prevalence and risk factors for obesity in adult dogs from private US veterinary practices. *International Journal Application Research of Veterinary Medicine.* 2006;4:177-186.
16. Nandini MK, Kamran CA, Yathiraj S, Upendra HA, Kumar VG, Rao S. Hematological, biochemical and lipid profile changes associated with obesity in dogs. *Indian Veterinary Journal.* 2012;89(9):79-81.
17. Nandini. Studies on obesity in dogs. M.V.Sc. Thesis submitted to Karnataka Veterinary Animal and Fisheries Sciences University, Bider, 2010.
18. Nijima A. Afferent signals from leptin sensors in the white adipose tissue of the epididymis, and their reflex effect in the rat. *Journal of The Autonomic Nervous System.* 1998;73(1):19-25.
19. Ornelas PT, Salazar JJE, Martínez-Salgado H.

- Coexistence of obesity and anemia in children between 2 and 18 years of age in Mexico. Mexico Children's Hospital Medical Bulletin. 2011;68(6):431-437.
20. Oystein US, Knut H, Olav S. Blood and Its Function In: Physiology of Domestic Animals. 1st ed. Scandinavian Veterinary Press, Oslo, Norway, 2003, 281-303.
 21. Polonsky KS. Dynamics of insulin secretion in obesity and diabetes. International Journal of Obesity, 2000;24(S2):S29-S31.
 22. Radakovich LB, Truelove MP, Pannone SC, Olver CS, Santangelo KS. Clinically healthy overweight and obese dogs differ from lean controls in select CBC and serum biochemistry values. Veterinary Clinical Pathology. 2017;46(2):221-226.
 23. Ricci R, Gottardo F, Ferlito JC, Stefani A, Ravarotto L, Andrighetto I. Body condition score (BCS) and metabolic status of shelter dogs. Italian Journal of Animal Science. 2007;6(1):859-861.
 24. Ryder E, Diez-Ewald M, Mosquera J, Fernandez E, Pedreanez A, Vargas R, *et al.* Association of obesity with leukocyte count in obese individuals without metabolic syndrome. Diabetes and Metabolic Syndrome: Clinical Research and Reviews. 2014;8(4):197-204.
 25. Shah B, Jani R, Bhadesiya C. Obesity in dogs-A mini review. Biosciences. 2017;10(10):1865-1867.
 26. Simpson JW, Anderson RS, Markwell PJ. Clinical nutrition of the dog and cat. Blackwell Scientific Publications, 1993, 151.
 27. Smith EG, Davis K, Sulsh L, Harvey SC, Fowler KE. Canine recommended breed weight ranges are not a good predictor of an ideal body condition score. Journal of Animal Physiology and Animal Nutrition. 2018;102(4):1088-1090.
 28. Snedecor GW, Cochran WG. Statistical methods, 8thed. Low State University Press, USA, Oxford and IBH publication. New Delhi, 2004, 591.
 29. Vuong J, Qiu Y, La M, Clarke G, Swinkels DW, Cembrowski G. Reference intervals of complete blood count constituents are highly correlated to waist circumference: Should obese patients have their own normal values?. American Journal of Haematology. 2014;89(7):671-677.
 30. Ward E, German AJ, Churchill JA. The Global Pet Obesity Initiative Position Statement, 2018, 1-7.
 31. Zhang Y, Ma AQ, Gong M, Lu Q, Lu M, Tian G. Red blood cell level is increased in obese but not in non-obese patients with coronary heart disease. Journal of Geriatric Cardiology. 2010;7:143-146.