

## Epidemiological Study of Canine Diabetes Mellitus in Jaipur Region of Rajasthan

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**ABSTRACT:** Diabetes mellitus is a common endocrine disorder seen in canines and felines. The objective of this study was to investigate the incidence of diabetes mellitus in canines of Jaipur region of Rajasthan. During April 2022 and September 2022, two hundred canines of varying age, gender, and breed were included in our study. Out of two hundred canines, nine cases were diagnosed for diabetes mellitus. The overall incidence rate was 4.5%. The incidence was higher in older canines than in younger ones, with the highest incidence (55.55%) occurring in dogs older than six years. In dogs, females (66.66%) had a considerably greater incidence of diabetes mellitus than males (33.33%). In our study, the most cases of diabetes mellitus were reported in the Labrador breed, followed by two cases in the Pug breed and one case each in the Spitz, Pomeranian, German shepherd and Rottweiler breeds. In our study main challenges were that pets also faced other complications with diabetes mellitus like chronic renal disease, hepatomegaly and muscle degeneration. The owner also need to regular in touch with clinician for routine glucose examination after a regular interval of time.

**Keywords:** Diabetes, Jaipur, incidence, canines, Breed.

### INTRODUCTION

Hyperglycemia, the primary symptom of diabetes mellitus (DM), can be caused by both deficiencies in insulin secretion (absolute insulin deficit) and decreased insulin sensitivity in target tissues (relative insulin deficiency) (Catchpole *et al.*, 2013). Polydipsia, polyuria, polyphagia, weight loss, and glucosuria are the most prominent clinical features (Sidhu and Randhawa 2019). Hyperglycemia can be caused by a number of different things, but generally falls into one of two categories: either primary insulin insufficiency or insulin resistance (Catchpole *et al.*, 2008). Obesity, poor nutrition, toxic chemical or medication exposure leading to insulin resistance, immune-mediated islet cell destruction, and islet cell destruction as a result of pancreatitis are all possible contributors to the onset of diabetes mellitus. Most dogs with diabetes mellitus are older than five years old, according to previous epidemiological studies, and female dogs have a higher risk than males (Marmor *et al.*, 1982; Guptill *et al.*, 2003). In a recent study in a population of 5,213 dogs, 29 diabetic dogs were found, the prevalence and incidence rate is 0.56 per cent and 0.37 per cent Meena *et al.*,

respectively (Brito-Casillas *et al.*, 2021). In another study reported that the prevalence of diabetes mellitus was 0.55 per cent (18/3240). The highest prevalence was recorded in dogs of above 10 years (2.13 %) of age while lowest prevalence in dogs of 1-5 years (0.20 %) of age. The highest prevalence (2.73 %) was observed in Pomeranian breed of dogs while the lowest (0.4 %) was recorded in GSD. The prevalence in male dogs was higher (0.41 %) than female (0.01 %) (Joshi, 2022). Pets had an incidence of 1.3 per 1000 dog-risk years and 2.2 per 1000 cat-risk years of diabetes (Delicano *et al.*, 2020). Golden retrievers, German shepherds, Labrador retrievers, and Keeshonds are among the most at-risk dog breeds for developing diabetes mellitus (Neiger *et al.*, 1996). In a recent study from February 2018 to March 2019, Diabetes mellitus was found in twelve of 1212 dogs. Diabetes mellitus-affected dogs epidemiological patterns and sequelae were investigated. Overall, the incidence rate was 0.99 percent. The prevalence was higher in older dogs than in younger dogs, with the highest incidence (58.33%) occurring in dogs over the age of five. Males were more likely than females to develop diabetes mellitus.

Diabetes mellitus was shown to be more prevalent in labrador and pomeranian breeds than in mongrel, pug, and cocker spaniel breeds (Kapoor *et al.*, 2021). In another study, 276 dogs with canine diabetes mellitus were observed. The whole population's mean age was 9±0.17 years (range 2 to 16), and the mean body weight (BW) was 15.4±12.04 kg (range 1.5 to 55.9). Diabetes was found in mixed breeds (33%), labrador retrievers (9.1%), tiny schnauzers (5.4%), miniature pinschers (5.1%) and other breeds. In terms of gender, 52 per cent were female (40% were intact and 96% were spayed) and 48 per cent were male (6% intact and 94% neutered) (Ward *et al.* 2021). Diabetes mellitus is related with particular breeds and concurrent health conditions are associated with an increased risk of diabetes mellitus (Heeley *et al.*, 2020).

## MATERIALS AND METHODS

The present research work was carried out in the Department of Veterinary Medicine, PGIVER Jaipur and Govt. Veterinary Polyclinic Hospital, Panchbatti, Jaipur (Rajasthan) during the period April 2022 to September 2022. Preliminary screening of two hundred canines was done on the basis of history and clinical signs. The inclusion criterion was polydipsia, polyuria, obesity, polyphagia, weakness or fatigue, rapid weight loss, rapidly developing bilateral cataracts and consistent fasted blood glucose level above 140 mg/dl. The incidence of diabetes mellitus overall and its incidence in respect to age, sex, and breed were determined using records of all diabetic dogs seen during this time period. Affected dogs were divided into 3 groups: young (< 1 year), adult (1-6 years) and old (> 6 years) to record age wise incidence. Breeds of diabetic dogs were recorded to see breed distribution.

Dogs that were thought to have diabetes mellitus had their blood tested for glucose levels using an in-house glucometer. The current investigation included dogs whose random blood glucose levels were higher than 140 mg/dl and whose fasting blood glucose levels were higher than 140 mg/dl after a 12-hour fast (Deepa, 2014; Jatav, 2015; Chaudhary, 2021).

## RESULTS AND DISCUSSION

A total number of 200 canines cases were presented to clinics of Department of Veterinary Medicine, PGIVER Jaipur and Govt. Veterinary Polyclinic Hospital, Panchbatti, Jaipur (Rajasthan) with various ailments. Out of 200 canines, 9 cases of canines with diabetes mellitus were recorded. Thus, overall incidence of canine diabetes mellitus was 4.5% (Table 1). Kumar *et al.* (2014), Anonymus (2012); Shruthi (2016); Chaudhary (2021) studied prominent incidence of 10.88, 10.88, 10.00 and 5.5 per cent, respectively in diabetes mellitus affected canines. However, Catchpole *et al.* (2005); Fall *et al.* (2007); Watson *et al.* (2011); Huang (2012); Nelson and Reusch (2014); Mattin *et al.* (2014); Deepa *et al.* (2014); Brito-Casillas *et al.* (2021); Kapoor *et al.* (2021) reported low incidence rate of 0.0005 to 1.5, 1.83, 2.0, 0.13 to 0.64, 0.6, 0.34, 0.4 to 1.2, 0.37 and 0.99 per cent, respectively. Meanwhile, the prevalence of diabetes mellitus was recorded as

0.55 per cent (Joshi, 2022). Diabetes is reported to affect anywhere, but experts believe that this disease is on the rising trend (Catchpole *et al.*, 2005). There was a sharp increase in the number of canine DM cases from 2006 to 2010, as reported by Banfield Hospital in the United States (Kumar *et al.*, 2014). The preference for breeds predisposed to DM, the increased reliance on commercial pet food, the lack of exercise, the unrestricted feeding of or preference for high-fat pet foods, and the urbanisation of human population and occupations leading to a change in pet dogs' lifestyles are additional potential contributing factors to the increased incidence of DM (Klinkenberg *et al.*, 2006).

Gender wise incidence revealed higher occurrence in females (66.66%) than males (33.33%) (Table 2). These findings correlate with Fall *et al.* (2007) who reported that more than 70% of the diabetes mellitus cases were in female dogs. Fall *et al.*, (2007), Das and Lodh, (2015), Catchpole *et al.*, (2005), and reported similar finding in females that were 72%, 73.3%, and 53% respectively. According to reports from Herriage (2009), Kumar *et al.* (2014) and Shruthi (2016), female canines were found to be more severely impacted by diabetes mellitus. The reason behind high female predisposition to DM was suggested to be hormonal effect particularly in long diestrus phase of oestrus cycle of intact female dogs (Klinkenberg *et al.*, 2006). Insulin resistance that is severe enough to lead to diabetes mellitus can appear in entire females during the progesterone-dominant phase of diestrus, and growth hormone production by the mammary glands further leads to reduced glucose tolerance and diabetes mellitus (Selman *et al.*, 1994).

It was discovered that the labrador breed has the greatest breed-specific incidence of canine diabetes mellitus, that was (33.33%) and pug (22.22%), followed by spitz (11.11%), pomeranian (11.11%), german shepherd (11.11%) and rottweiler (11.11%), respectively (Table 3). Breed wise difference in canine diabetes mellitus has also been documented by Hess *et al.* (2000), Guptill *et al.* (2003), Kennedy *et al.* (2003), Rand *et al.* (2004); Davison *et al.* (2005); Catchpole *et al.* (2005); Watson *et al.* (2011); Fall *et al.* (2007); Klinkenberg *et al.* (2006); Mori *et al.* (2010), Deepa *et al.* (2014), Westermarck *et al.* (2010), Huang (2012), Catchpole *et al.* (2013); Kumar *et al.* (2014), Das and Lodh (2015), Jena (2016), Shruthi (2016) and Chaudhary (2021). The labrador breed of dogs showed significant increase in incidence rate of DM, as compared to other breeds, which is agreement with our observations. Deepa *et al.* (2014); Fall *et al.* (2007), Jena (2016); Shruthi (2016), Chaudhary (2021) noted that the survey revealed a higher prevalence of the labrador breed. In contrast to this, the German shepherd dog breed had the lowest prevalence (0.4%) and the Pomeranian dog breed had the highest prevalence (2.73%) (Joshi, 2022).

The most sensitive dog breeds share comparable haplotypes and genotypes at the major histocompatibility complex (MHC) class II genes (dog leucocyte antigen; DLA) on canine chromosome 12 (Catchpole *et al.*, 2005). The MHC class II molecules

are the ones that show T lymphocytes the antigen. In canines, there is a mixture of monomorphic and polymorphic DLA genes and loci. Accordingly, the breed propensity to canine DM changes according to variance in the DLA gene pool (Kumar *et al.*, 2014; Catchpole *et al.*, 2008). One reason there are more diabetic dogs in the canine community is that people are choosing dog breeds known to be susceptible to the disease (Klinkenberg *et al.*, 2006).

According to the results of the current study, the incidence of diabetes mellitus in dogs rise with age, with dogs older than 6 years of age showing the highest incidence (55.55%), followed by dogs between 1 and 6 years of age (33.33%), and finally, dogs younger than 1 year of age (11.11%) (Table 4). Similar findings were also reported by Foster (1975); Marmor *et al.* (1982); Dixon and Sanford (1961); Gupta *et al.* (2003); Hess *et al.* (2000); Rand *et al.* (2004); Kumar *et al.* (2014); Fall *et al.* (2007); Kawasumi *et al.* (2014); Shruthi (2016). Dogs older than six years of age had a greater Incidence

of DM, as shown by our research and corroborated by various authors (Deepa *et al.*, 2014; Catchpole *et al.*, 2005; Davison *et al.*, 2005 and Chaudhary, 2021). These researcher found that the prevalence was greater in older dogs. Meanwhile, the highest prevalence was recorded in dogs of above 10 years (2.13 %) of age while lowest prevalence in dogs of 1-5 years (0.20%) (Joshi, 2022).

Insulin resistance, which has been described in cases of adult canine diabetes mellitus, has been linked to exogenous corticosteroids, progestagen treatment, or endocrinopathies including hyperadrenocorticism and hypothyroidism (Hess *et al.*, 2000). Only 9 of 500 dogs in a study had juvenile onset diabetes, showing that the condition is relatively uncommon in dogs. Only a few of cases were found in animals younger than six months old, and those were thought to be congenital (Davison, 2015). Ageing is now recognised as a major contributor to canine diabetes mellitus. Dogs in the middle-aged to senior range are most at risk (Davison *et al.*, 2005).

**Table 1: Overall incidence of diabetes mellitus in canines.**

Total no. of canines screened	No. of canines affected with diabetes mellitus	Percentage of canines affected with diabetes mellitus
200	9	4.5 %

**Table 2: Incidence of diabetes mellitus in relation to the sex.**

Sr. No.	Sex	No. of positive cases (9)	Percentage (%)
1.	Male	3	33.33 %
2.	Female	6	66.66 %

**Table 3: Incidence of diabetes mellitus with relation to breed.**

Sr. No.	Breed	No. of positive cases (9)	Percentage (%)
1.	Labrador	3	33.33 %
2.	Spitz	1	11.11 %
3.	Pomeranian	1	11.11 %
4.	German shepherd	1	11.11 %
5.	Rottweiler	1	11.11 %
6.	Pug	2	22.22 %

**Table 4: Incidence of diabetes mellitus in different age groups.**

Sr. No.	Age (Years)	No. of positive cases (9)	Percentage (%)
1.	< 1 year	1	11.11 %
2.	1-6 years	3	33.33 %
3.	> 6 years	5	55.55%

## CONCLUSIONS

Diabetes mellitus, with an overall incidence of 4.5 percent were found in this study. It is a disease of middle and old aged dogs. The study showed that highest incidence in dogs more than 6 years of age and females were at increased risk for diabetes mellitus as compared to males. Breed susceptibility with highest incidence shown in Labrador suggested genetic predisposition.

## FUTURE SCOPE

In future there is a possibility of study of diabetes mellitus in feline population and also scope of study of complication associated with diabetes mellitus.

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**Conflict of Interest.** None.

## REFERENCES

- Anonymous (2012). Management of chronic pancreatic disorders with special reference to diabetes mellitus in dogs. Annual Report of Indian Veterinary Research Institute, Izzatnagar, pp 56.
- Brito-Casillas, Y., Melian, C., Holder, A., Wiebe, J. C., Navarro, A., Quesada-Canales, O. and Wagner, A. M. (2021). Studying the heterogeneous pathogenesis of canine diabetes: Observational characterization of an

- island population. *Veterinary Medicine and Science*, 7(4), 1071-1081.
- Catchpole, B., Adams, J. P., Holder, A. L., Short, A. D., Ollier, W. E. and Kennedy, L. J. (2013). Genetics of canine diabetes mellitus are the diabetes susceptibility genes identified in humans involved in breed susceptibility to diabetes mellitus in dogs. *The Veterinary Journal*, 195(2), 139-147.
- Catchpole, B., Kennedy, L. J., Davison, L. J., and Ollier, W. E. R. (2008). Canine diabetes mellitus: from phenotype to genotype. *Journal of small animal practice*, 49(1), 4-10.
- Catchpole, B., Ristic, J. M., Fleeman, L. M. and Davison, L. J. (2005). Canine diabetes mellitus can old dogs teach us new tricks. *Diabetologia*, 48(10), 1948-1956.
- Chaudhary, S. (2021). Clinical studies on diabetes mellitus in canine. M.V.Sc. thesis submitted to Rajasthan university of veterinary and animal sciences, Bikaner. pp 1-123
- Das, S. and Lodh, C. (2015). Epidemiology of canine diabetes mellitus in West Bengal. *Indian Journal of Canine Practice*, 7(1), 66.
- Davison, L. J. (2015). Diabetes mellitus and pancreatitis—cause or effect? *Journal of Small Animal Practice*, 56, 50-59.
- Davison, L. J., Herrtage, M. E. and Catchpole, B. (2005). Study of 253 dogs in the United Kingdom with diabetes mellitus. *Veterinary Record*, 156(15), 467-471.
- Deepa, P. M., Dimri, U., Jhambhi, R., Ramees, T. P., Vijaykumar, H., Gopinath, D., Mahendran, K. and Mondal, D. B. (2014). Secondary subclinical diabetes mellitus in dogs infected with Ehrlichia canis. *International Journal of Advance Research*, 2(1), 858-863.
- Delicano, R. A., Hammar, U., Egenvall, A., Westgarth, C., Mubanga, M., Byberg, L. and Kennedy, B. (2020). The shared risk of diabetes between dog and cat owners and their pets: register based cohort study. *British Medical Journal*, 371, 1-11.
- Dixon, J. B. and Sanford, J. (1961). Canine diabetes mellitus—A report of fourteen cases. *Journal of Small Animal Practice*, 2(1-4), 9-17.
- Fall, T., Hamlin, H.H., Hedhammar, A., Kampe, O. and Egenvall, A. (2007). Diabetes mellitus in a population of 180,000 insured dogs: incidence, survival, and breed distribution. *Journal of Veterinary Internal Medicine*, 21, 1209-1216.
- Foster, S.J. (1975). Diabetes mellitus a study of the disease in the dog and cat in Kent. *Journal of Small Animal Practice*, 16, 295-315.
- Guptill, L., Glickman, L. and Glickman, N. (2003). Time trends and risk factors for diabetes mellitus in dogs: Analysis of veterinary medical data base records (1970–1999). *The Veterinary Journal*, 165, 240-247.
- Heeley, A. M., O'Neill, D. G., Davison, L. J., Church, D. B., Corless, E. K. and Brodbelt, D. C. (2020). Diabetes mellitus in dogs attending UK primary care practices: frequency, risk factors and survival. *Canine Medicine and Genetics*, 7(1), 1-19.
- Herrtage, M. E. (2009). Proceedings of the 34th world small animal veterinary Congress. *WSAVA Med*. 41, 177-184.
- Hess, R. S., Saunders, H. M., Winkle, T. J. and Ward, C. R. (2000). Concurrent disorders in dogs with diabetes mellitus: 221 cases (1993-1998). *Journal of the American Veterinary Medical Association*, 217, 1166-1173.
- Huang, A. (2012). Canine diabetes mellitus. *Clinician's Brief*. pp 47-50.
- Jatav, R. S. (2015). Screening of dogs for diabetes mellitus in gwalior and vidisha districts of Madhya Pradesh and role of antioxidant in experimental diabetes. PhD thesis submitted to Indian Veterinary Research Institute, Izzatnagar, Uttar Pradesh.
- Jena, R. G. (2016). Prevalence, clinico-biochemical and therapeutics of diabetes mellitus in dogs. PhD thesis submitted to Orissa University of Agriculture and Technology, Bhubaneswar. pp 1-81.
- Joshi, M. (2022). Studies on prevalence and comparative efficacy of neutral protamine hagedorn and insulin degludec in canine diabetes mellitus. M.V.Sc. thesis submitted to Nanaji Deshmukh Veterinary Science University, Jabalpur.
- Kapoor, S., Wadhwa, D. R., Kumar, S. and Sharma, P. (2021). Epidemiological study of canine diabetes mellitus in palam valley of Himachal Pradesh and its complication. *Himachal Journal of Agricultural Research*, 46(2), 188-192.
- Kawasumi, K., Kashiwado, N., Okada, Y., Sawamura, M., Sasaki, Y., Iwazaki, E., Mori, N., Yamamoto, I. and Arai, T. (2014). Age effects on plasma cholesterol and triglyceride profiles and metabolite concentrations in dogs. *BioMed Central Veterinary Research*, 10(1), 1-5.
- Kennedy, L.J., Davison, L.J., Barnes, A., Isherwood, D., Ollier, W. E. R. and Catchpole, B. (2003). Susceptibility to canine diabetes mellitus is associated with MHC class II polymorphisms. *British Small Animal Veterinary Association Congress Science Proceeding*, pp 593-594.
- Klinkenberg, H., Sallander, M. H. and Hedhammar, A. (2006). Feeding, exercise, and weight identified as risk factors in canine diabetes mellitus. *The Journal of nutrition*, 136(7), 1985S-1987S.
- Kumar, P., Kumari, R. R., Kumar, M., Kumar, S. and Chakrabarti, A. (2014). Current practices and research updates on diabetes mellitus in canine. *Veterinary World*, 7, 952-959.
- Marmor, M., Willeberg, P., Glickman, L. T., Priester, W. A., Cypess, R. H. and Hurvitz, A. I. (1982). Epizootiologic patterns of diabetes mellitus in dogs. *American journal of veterinary research*, 43(3), 465-470.
- Mattin, M., O'Neill, D., Church, D., McGreevy, P. D., Thomson, P. C. and Brodbelt, V. (2014). An epidemiological study of diabetes mellitus in dogs attending first opinion practice in the UK. *Veterinary Record*, 174(14), 349-349.
- Mori, N., Lee, P., Muranaka, S., Sagara, F., Takemitsu, H., Nishiyama, Y., Yamamoto, I., Yagishita, M. and Arai, T. (2010). Predisposition for primary hyperlipidemia in miniature schnauzers and shetland sheepdogs as compared to other breeds. *Research in Veterinary Science*, 88(3), 394-399.
- Neiger, R., Jaunin, V. B. and Boujon, C. E. (1996). Exocrine pancreatic insufficiency combined with insulin-dependent diabetes mellitus in a juvenile german shepherd dog. *Journal of Small Animal Practice*, 37, 344-349.
- Nelson, R. W. and Reusch, C. E. (2014). Classification and etiology of diabetes in dogs and cats. *Journal of Endocrinology*, 222, T1-T9.
- Rand, J. S., Fleeman, L. M., Farrow, H. A., Appleton, D. J. and Lederer, R. (2004). Canine and feline diabetes mellitus: nature or nurture? *The Journal of Nutrition*, 134, 2072-2080.

- Selman, P. J., Mol, J. A., Rutteman, G. R. and Rijnberk, A. (1994). Progestin treatment in the dog. Effects on growth hormone, insulin-like growth factor I and glucose homeostasis. *European Journal of Endocrinology*, 131, 413-421.
- Shruthi, J. S. (2016). Certain studies on diabetes mellitus in canines M.V.Sc. thesis submitted to Karnataka veterinary, animal and fisheries sciences university, Bidar. pp 1-156.
- Sidhu, S. and Randhawa, S. S. (2019). A review on diagnosis and management of diabetes mellitus in dogs. *International Journal of Current Microbiology and Applied Sciences*, 8(6), 10-16.
- Watson, P. J., Roulois, A., Scase, T., Holloway, A. and Herrtage, M. E. (2011). Characterization of chronic pancreatitis in english cocker spaniels. *Journal of Veterinary Internal Medicine*, 25(4), 797-804.
- Ward, C. R., Christiansen, K. Li. J., Bryson, W. L., Jerrentrup, K. A. and Kroh, C. (2021). Field efficacy and safety of protamine zinc recombinant human insulin in 276 dogs with diabetes mellitus. *Domestic Animal Endocrinology*, 75, 106575.
- Westermarck, E., Saari, S. A. and Wiberg, M. E. (2010). Heritability of exocrine pancreatic insufficiency in german shepherd dogs. *Journal of Veterinary Internal Medicine*, 24, 450-452.

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