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Epidemiological study of canine diabetes mellitus in Palam valley of Himachal Pradesh and its complications

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Abstract

The present study was conducted to investigate diabetes mellitus (DM) in dogs of Palam valley of Himachal Pradesh. A total number of 1212 dogs were presented during February 2018 to March 2019. Out of 1212 dogs, twelve cases were diagnosed for diabetes mellitus. The epidemiological pattern and complications in the diabetes mellitus affected dogs were studied. The overall incidence rate was 0.99% and maximum number of cases (8/12) were recorded in winter season (November to February). The incidence was greater in older compared with younger dogs with highest incidence (58.33%) occurring in dogs >5 years of age. Males had an increased risk of diabetes mellitus as compared with females. Breeds like Labrador and Pomeranian were found to be more susceptible as compared to breeds like Mongrel, Pug and Cocker spaniel to diabetes mellitus. The common chronic complications such as cataract and anterior uveitis were recorded. Subclinical urinary tract infections (UTI) were the most common concurrent disorder in diabetes mellitus followed by subclinical neuropathy and hepatic lipidosis.

Key words: Cataract, Diabetes, Dogs, Hyperglycemia, Incidence.

Spontaneous diabetes mellitus (DM) is one of the commonest endocrine disorders in dogs, with certain breeds shown to have either an increased or decreased risk of developing the disease (Marmor *et al*. 1982). The four classic signs of diabetes mellitus are polyuria, polydipsia, polyphagia, and weight loss. The etiology of canine diabetes mellitus is considered multifactorial and may be broadly divided into insulin resistance and insulin deficiency. Factors including obesity, diet, exposure to toxic chemicals or drugs that cause insulin resistance, immune-mediated destruction of islet cells, and destruction of islet cells secondary to pancreatitis may all play a role. Previous epidemiologic studies have reported that most affected dogs are >5 years of age at the onset of diabetes mellitus and female dogs are at increased risk than males (Marmor *et al.* 1982; Guptill *et al.* 2003). Some studies of dogs have indicated a winter peak for the onset of diabetes mellitus (Davison *et al.* 2005) whereas other studies have shown no seasonal predisposition (Guptill *et al.* 2003). The purpose of the study reported here was to provide population-based information on diabetes mellitus in dogs, regarding general incidence, incidence by age, sex, breed and seasonal influence on occurrence of diabetes mellitus in Palam valley of Himachal Pradesh. The second objective of the present study was to provide an insight into the complications as well as concurrent disorders that occur in the course of the disease.

Materials and Methods

The present research work was carried out in the Department of Veterinary Medicine, College of Veterinary and Animal Sciences, CSKHPKV Palampur (HP) during the period February 2018 to March 2019. Preliminary screening of dogs was done on the basis of history and clinical signs.The inclusion criterion was polydipsia, polyphagia, polyuria and consistent fasted blood glucose level above 160 mg/dl. Records of all diabetic dogs seen over this time period were used to calculate hospital incidence of diabetes mellitus and incidence in relation to age, sex and breed. Affected dogs were divided into 3 categories: young (< 1 year), adult (1 – 5 years) and old (> 5 years) to record age wise incidence.The study period was divided into three seasons i.e. Summer (March to June), Monsoon (July to

October) and Winter (November to February) to record seasonal wise incidence of diabetes mellitus in dogs. Breeds of diabetic dogs were recorded to see breed distribution. The affected dogs were clinically examined to check for any concurrent disorder or complication of diabetes mellitus.

Results and Discussion

A total number of 1212 dogs cases were presented to clinics of Dr. G.C. Negi COVAS Palampur from February 2018 to March 2019 with various ailments. Out of 1212 dogs, 12 cases of dogs with canine diabetes mellitus were recorded. Thus, overall incidence of canine diabetes mellitus was 0.99%. These findings simulate with Nelson and Reusch (2014) who reported hospital incidence rate of diabetes mellitus as 0.4 to 1.2%. Catchpole *et al.* (2005) also reported that the incidence of diabetes mellitus was between 0.0005% and 1.5%. However, Fall *et al.* (2007) reported that the overall incidence of diabetes mellitus in their study was 13 cases per 10,000 dogs. Age wise highest incidence was recorded in old age group (58.33%) followed by adult age (33.33%) and minimum incidence was recorded in young age group (8.33%). Our observations simulate with the findings of Hess *et al*. (2000), Guptill *et al.* (2003), Rand *et al.* (2004) and Fall *et al.* (2007). These authors reported higher incidence in older dogs (more than 5 years) and the incidence was found to increase with advancing age with highest incidence occurring in dogs of 10 to 15 years age group. The probable reason was suggested to be insulin resistance which was observed in 20 to 40% of adult canine diabetes mellitus cases and was attributed to exogenous corticosteroids, progestagen treatment or endocrinopathies like hyperadrenocorticism and hypothyroidism (Hess *et al*. 2000; Handisurya *et al.* 2008; Maratou *et al*. 2009).

Juvenile onset diabetes is said to be uncommon in dogs. In this study only one case was found to be of juvenile onset diabetes in which age of dog was less than 1 year (6 months). Similarly, Catchpole *et al.* (2005) also reported that in a series of 500 affected animals, only 9 were found to be less than 12 months of age. Small number of cases are diagnosed in young animals less than six months of age and they are considered to be congenital in origin (Davison 2015). Usually such cases do not suffer from exocrine pancreatic disease so the pathology is considered to be β-cell specific. The etiology of β-cell destruction in diabetic dogs is often unknown but it was considered to be caused by immune-mediated process similar to human type 1 diabetes (Rand *et al.* 2004).

Genderwise incidence revealed higher occurrence in males (66.66%) than females (33.33%). This pattern of case presentation might be due to the fact that more number of male pets are kept in the locality. These findings did not correlate with Fall *et al.* (2007) who reported that more than 70% of the diabetes mellitus cases were in female dogs. Similar findings were recorded by Marmor *et al.* (1982) where male female ratio was approximately equal to 1 at ages less than 1 year, while females predominated at older ages in diabetes mellitus cases. 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 severe enough to culminate in diabetes mellitus can arise in progesterone-dominant phase of diestrus in entire females, during which growth hormone production by the mammary glands also contribute to poor glucose tolerance and diabetes mellitus (Selman *et al.* 1994).

Breed wise incidence among investigated cases of diabetes mellitus in dogs indicated that Labrador constituted the largest group followed by Pomeranian and Mongrel and least incidence was observed in Pug and Cocker spaniel. In agreement to these observations, breed wise difference in canine diabetes has been documented by Rand *et al.* (2004) and Catchpole *et al*. (2005) where high incidence was recorded in Samoyed, Alaskan Malamute, Tibetan terrier, Cairn terrier, Fox Terrier, Manchester Terrier, Finnish Spitz and Miniature Schnauzer while others like Boxer, German Shepherd, American Pit Bull Terrier and Golden Retriever were found less susceptible. Diabetes mellitus in dogs was associated with major histocompatibility complex (MHC) class II genes (dog leucocyte antigen; DLA), located on canine chromosome 12 with similar haplotypes and genotypes being identified in the most susceptible breeds (Catchpole *et al.* 2005). MHC class II are responsible for presenting antigen to T lymphocyte. Some DLA genes are monomorphic, and others loci are polymorphic in canines. Therefore, depending on variation in gene pool of DLA, the susceptibility to autoimmune disease varies and so the breed predisposition to canine diabetes mellitus (Catchpole *et al.* 2008; Kumar *et al.* 2014).

Table 1. **Age and Gender/wise Incidence of Diabetes mellitus**

S. No.	Age group	No. of Positive cases	Sex	
			Male	Female
1.	Young (< 1 year)	1	1	0
2.	Adult (1-5 years)	4	3	1
3.	Old (> 5 years)	7	4	3
	Total	12	8	4

Table 2. **Breed wise incidence of Diabetes mellitus**

S. No.	Breed	No. of cases	Percentage (%)
1	Labrador	5	41.66
2	Mongrel	2	16.66
3	Pug	1	8.33
4	Pomeranian	3	25.00
5	Cocker spaniel	1	8.33
	Total	12	100

Season-wise influence on occurrence of diabetes mellitus was recorded in this study as majority of cases were presented during cold months of the year i.e. winter season with highest incidence (8/12, 66.66%), followed by monsoon season (3/12, 25%) and minimum incidence was reported during summer season (1/12, 8.33%). These findings were in correlation with Catchpole *et al*. (2005) and Kumar *et al.* (2014) who in their study reported that twice as many dogs were diagnosed with diabetes mellitus between November and January as between July and September thus indicating higher incidence in winters. On the contrary, a tendency towards occurrence of more cases in spring (April-June) was recorded in the female dogs in a study conducted by Fall *et al.* (2007). However, no apparent seasonal pattern in the prevalence of diabetes mellitus in dogs was observed by Marmor *et al.* (1982) and Guptill *et al.* (2003).

Diabetic dogs often suffer with chronic complications of DM as well as concurrent disorders during the course of disease. Few complications are acquired due to insulin therapy (hypoglycemia, Somogyi response) and some due to hospital visits (stress hyperglycemia). In this study, cataract was present in 5 (41.66%) out of 12 dogs. Out of these 5 dogs, 3 had cataract at the time of diagnosis and 2 dogs developed cataract at a later stage. In a previous study conducted by Marmor *et al.* (1982) it was reported that thirteen out of 18 diagnosis of cataracts in diabetic dogs occurred at the time of or after diagnosis of diabetes, whereas 5 diagnosis of cataracts occurred before diagnoses of diabetes. The onset of diabetic cataract involves several factors like osmotic changes in the lens, glycosylation of structural proteins and a decreased concentration of antioxidants (Kumar *et al.* 2014). In this study, anterior uveitis was seen in 3 (25.00%) out of 12 dogs. 8 dogs showed subclinical urinary tract infection and 2 dogs were observed with subclinical neuropathy at the time of diagnosis. Hess *et al.* (2000) also reported urinary tract infections (UTIs) in 21% to 37% of dogs with DM being culture-positive at presentation. Potential mechanism suggested was enhanced bacterial growth in urine due to the presence of glucosuria and decreased neutrophilic chemotaxis secondary to the glucosuria (Latimer and Mahaffey 1984; Forrester *et al*. 1999). Hepatic lipidosis and neoplasia on kidney were found in one dog each and 2 dogs had moderate spleenomegaly. Hess *et al.* (2000) also reported some concurrent disorders in diabetic dogs, for example hepatomegaly in 61% diabetic dogs, spleenomegaly in 2 out of 46 dogs radiographed and hyperechoic liver in 104 dogs out of 127 dogs subjected to ultrasonography.

Table 3.Complications & concurrent disorders in diabetic dogs

S. No.	Complication & Concurrent Disorder	Affected animals	Percentage
1	Hypoglycemia	3	25.00 %
2	Somogyi response	1	8.33 %
3	Stress hyperglycemia	1	8.33 %
4	Cataract	5	41.66 %
5	Anterior uveitis	3	25.00 %
6	Subclinical urinary tract infection	8	66.66 %
7	Subclinical neuropathy	2	16.66 %
8	Hepatic lipodosis	1	8.33 %
9	Moderate spleenomegaly	2	16.66 %
10	Neoplasia on kidney	1	8.33 %

Conclusion

Diabetes mellitus with an overall incidence of 0.99% is a disease of middle and old aged dogs. The study showed highest incidence in dogs more than 5 years of age and males were at increased risk for diabetes mellitus as compared to females. Breed susceptibility with highest incidence shown in Labrador suggested genetic predisposition. Seasonal influence showed highest incidence in winter season and subclinical urinary tract infection was recorded as most common concurrent disorder in diabetes mellitus.

Conflict of interest: There is no conflict of interest among the authors.

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