

THERAPEUTIC MANAGEMENT OF CANINE DIABETES MELLITUS USING HERBAL THERAPY COMBINED WITH INSULIN, RESTRICTED FAT AND HIGH FIBER DIET

Surojit Das¹ and Chandan Lodh²

¹P.G. Scholar, ²Professor, Department of Veterinary Medicine, Ethics and Jurisprudence.
Faculty of Veterinary and Animal Sciences; West Bengal University of Animal and Fishery Sciences;
68, K.B. Sarani, Belgachia, Kolkata-700037.

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The aim of the study was to investigate the effect of *Momordica charantia* (MC) capsules combined with insulin hormone, restricted fat and high fiber diet on the treatment of diabetic dogs. In the present investigation eighteen clients owned diabetic dogs were divided into two groups and treated with two different combinations of drugs. The fasting blood glucose level, serum fructosamine concentration, glycosylated haemoglobin along with serum liver enzyme and albumin were estimated on pre and post treatment periods for the diagnosis and assessment of treatment efficacy. All the above mentioned parameters significantly increased in diabetic dogs compare to healthy dogs and there after significantly reduced in both the treatment group. In conclusion, MC capsules @200mg/kg b. wt./day combined with insulin @ 1 IU/kg.b.wt. s/c and restricted fat and high fiber diet improve glycaemic control more efficiently than diabetic treatment with insulin hormone alone.

Keywords: Canine, Diabetes mellitus, Fat-high fiber diet, Glycosylated haemoglobin, Insulin, Serum glucose level, Serum fructosamine concentration.

Diabetes mellitus (DM) is the most common endocrine disorder of the pancreas resulting an absolute or relative deficiency of insulin. Dogs are virtually suffered from insulin dependent diabetes mellitus (IDDM) which is characterized by insufficiency of insulin from the destruction of beta cells with progressive and eventually complete insulin insufficiency (Einsenbarth, 1986). Therefore, insulin therapy is mandatory in diabetic dogs for their entire lives. In all diabetic dogs, several factors are used to formulate a treatment regimen for DM including adjustment in diet and exercise, correction of obesity, treatment of concurrent insulin-antagonistic disorders and avoidance of insulin- antagnotic drugs (Feldmen and Nelson, 1996). Since exogenous insulin is not as perfect as endogenous insulin that is produced from the pancreas, some diabetic dogs may develop humeral immune responses to exogenous insulin leading to failure in therapy of diabetes mellitus (Davison *et al.*, 2003). As such alternative therapy with herbal medicines may be a new therapeutic strategy which might be cheaper, safer and more convenient for treatment of DM. *Momordica charantia* is commonly known as

bitter gourd or karala. The extract of MC has shown antihyperglycemic effect in animal models such as alloxan induced diabetes (Kar *et al.*, 2003). The MC extract exerted both insulin secretagogue and insulin mimetic activities to lower blood glucose concentration. Therefore the aim of this study was to determine the effect of the MC capsule, combined with insulin injection on the improvement of glycaemic control in naturally occurring diabetes mellitus in dogs.

Materials and Methods:

Spontaneous clinical cases presented to Veterinary Clinics, Belgachia, West Bengal were used for the study. Clinical signs suggested of diabetes mellitus such as polyurea, polydypsia, weight loss inspite of a good appetite and lethargy along with other associated signs like dull hair coat, muscle wasting, tiredness, loss of vision were considered while selecting cases of diabetes mellitus. Diagnosis of diabetes mellitus is based on the combination of clinical signs, high blood glucose concentration and persistent glucosuria. In the present investigation eighteen dogs with type-1 diabetes mellitus were diagnosed based on history, clinical signs and estimation of blood

sugar and urine analysis. Five clinically healthy, mixed breed medium sized dogs weighting 10 ± 5 kg of both sexes were used in this study as healthy control. Blood samples of all dogs were collected for diagnostic or monitoring purposes from the cephalic vein or recurrent tarsal vein between 6 to 9 a.m. after 12 hours of fasting for the measurement of fasting blood glucose into floride heparin tube. Sample for serum fructosaamine and other bio chemical profiles were collected into plain tubes. Plasma and serum were separated by centrifugation at 2000 rpm for 2 minutes at 4°C and stored in polyvinyl tubes at -80°C until the test was performed.

All the positive dogs were divided into 2 groups having 9 animals in each group designated as group- T_1 and group T_2 . The dogs of T_1 group treated with insulin@ 1 IU/kg b. wt. s/c half an hour before major meal for two months and T_2 group was treated with insulin @ 1 IU/kg b. wt. s/c along with *Momordica charantia* capsules at the dose rate of 200 mg/kg b.wt./day with meal twice daily orally for two months. Blood samples were collected from treated group on 0 day, 30th day and 60th days of treatment between 6 to 9 a.m. after 12 hours of fasting. Serum glucose, serum alkaline phosphatase and serum albumin were estimated spectro photometrically using diagnostic kit (determination of glucose in serum reagent kit, marketed by RED SPAN, ALP was estimated by reagent kits TRANSASIA BIO-MEDICALS LTD and Albumin was estimated by BCG Dye by Transasia Bio-Medical Ltd.) The concentration of serum fructosamine was measured by an external

clinical pathological laboratory by using an automated enzymatic assay. The concentration of glycosylated haemoglobin was measured in EDTA blood sample using kit supplied by MERCK. The effect of the treatment in different groups were analysed by analysis of variance (Snedecor and Cochran).

Results and Discussion:

In the present investigation all the diabetic mellitus affected dog showed clinical signs of polyurea, polydypsia, weight loss inspite of a good appetite and lethargy, dull hair coat. The findings are corroborated with the findings of earlier worker who observed dull hair coat, muscle wasting, polyurea and polydypsia in diabetic dog by Davison *et al.* (2003). All the clinical signs disappear after 2 months of treatment.

From table-1 it is evident that there is significant increase of serum glucose, serum fructosamine, serum glycosylated haemoglobin, serum alkaline phosphatase (ALP), serum alanine amino transferase (ALT) and serum albumin level in diabetic dogs when compare with healthy control groups of animals. However after 2 months of treatment in both the groups all the parameters were significantly ($p < 0.01$) reduced except serum albumin. It also appeared that serum glucose, serum fructosamine, serum glycosylated haemoglobin level reduced significantly ($p < 0.05$) than that of group T_1 treatment after 2 months. Serum ALP and serum ALT and serum albumin level also altered towards normalcy in both the treatment group with slightly nearer to normal in group T_2 animals.

Table -1. Biochemical parameter of healthy and diabetic dogs before and after treatment.

Parameters	Healthy control group	Treatment group- T_1			Treatment group- T_2		
		0 days	1 month	2 month	0 days	1 month	2 month
Serum glucose (mg/dl)	98.40 ± 5.25	167.77 ± 13.15	$125.13 \pm 9.89^{**}$	$98.81 \pm 10.64^{**}$	172.26 ± 13.68	$125.77 \pm 12.99^{**}$	$96.18 \pm 10.38^{**}$
Serum Fructosamine (mmol. l)	3.02 ± 0.17	4.83 ± 0.25	$3.43 \pm 0.27^{**}$	$3.24 \pm 0.33^{**}$	4.46 ± 0.08	$3.14 \pm 0.16^{**}$	$3.06 \pm 0.21^{**}$

Glycosylated haemoglobin (%)	3.22 ± 0.11	10.82 ± 0.41	5.38 ± 0.39**	3.54 ± 0.28**	9.99 ± 0.46	5.64 ± 0.36**	3.28 ± 0.22**
Serum Alkaline Phosphatase (u/l)	101.29 ± 2.81	317.08 ± 7.81	257.47 ± 8.16*	144.06 ± 3.08**	318.39 ± 26.04	242.47 ± 9.85*	132.71 ± 4.59**
Serum Alanine aminotransferase (u/l)	35.63 ± 1.17	74.81 ± 2.91	55.35 ± 1.14**	42.28 ± 1.57**	75.55 ± 1.46	45.62 ± 2.16**	39.75 ± 2.75**
Serum Albumin (mg/dl)	3.36 ± 0.05	3.39 ± 0.13	3.36 ± 0.05 ^{NS}	3.44 ± 0.08 ^{NS}	3.42 ± 0.04	3.41 ± 0.11 ^{NS}	3.39 ± 0.17 ^{NS}

* p 0.01 (highly significant) , ** p 0.05 (significant), NS - Non significant.

Fructosamine is a glycosylated serum protein that is formed through irreversible non enzymatic reaction between glucose and serum protein. Glucose has a greater affinity for albumin in dogs as also reported by Reusch and Haberer (2001). Fructosamine concentration in serum directly depends on blood protein and plasma glucose concentration. The reduction of fructosamine concentration usually occurs when blood glucose concentration decreases resulting in decreasing affinity of glucose and serum protein. One time measurement of fructosamine concentration indicates the average glucose concentration over the previous 1-2 weeks. Fructosamine measurements used for diagnosis of diabetes mellitus, monitoring the effectiveness of insulin therapy and responding of antidiabetic drug treatment. In the present study, fructosamine concentration indicates the effectiveness of insulin therapy and responding of antidiabetic drug treatment and the results obtained in the study showed the effectiveness of the treatment in both the groups. The level of serum glycosylated haemoglobin in the diabetic dog significantly (p 0.01) decreased after one and two month of treatment in both the group. This changes observed due to glycosylated haemoglobin was formed as the result of an

irreversible non enzymatic insulin dependent binding of glucose to haemoglobin in red blood cells and the extent of this glycosylation was dependent on the concentration of glucose in the serum and this process takes a minimum of 4 weeks to 8 weeks period. Similar trend was noted in the present investigation and also corroborated the findings of Elliot *et al.* (1997).

In present study serum albumin was monitored at monthly interval and found in the normal level. The hypoglycaemic effect of the MC which are classified into three pathways insulin mimetic, insulin secretagogue and postprandial hyperglycaemic suppression. Insulin mimetic and postprandial hyperglycaemia mechanisms found in several studies. Since all dogs in this study had naturally occurring diabetes and were classified into IDDM, we did not observe the improvement of serum insulin concentrations neither before nor after treatment with MC capsules. In the study all diabetic dog had the higher serum ALT and serum ALP concentration. This finding is consistent with those of previous study (Balogh *et al.*, 2008) which demonstrated that high hepatic enzyme activities are commonly found in diabetic dogs. The liver specific enzyme ALT increased in diabetic dog before treatment reflected mild to moderate cell

damage that is related to decrease blood flow due to dehydration. Beside this there may be hepatic lipidosis developed secondary to diabetes mellitus because of increased lipid metabolism and mobilisation as evidenced by hepatomegaly and increase of ALT concentration in all the animals under present investigation. The mean level of ALT decreased and returned to normal physiological value may be attributed to the treatment with insulin and other hypoglycaemic drug. Earlier, it was also observed that hepatic lipidosis be reduced with insulin therapy by Leyva-Ocairz (1993).

The mean \pm S.E. specific gravity and pH of the urine of 18 cases were diagnosed with diabetic mellitus was found to be 1.026 ± 0.004 and 7 ± 0.011 respectively. In all the 18 cases, the urine samples were positive for glucose. Kumar *et al.* (2014) also noted similar finding in diabetes mellitus.

Conclusions

The results of our study demonstrated that MC capsules (200 mg/kg b.wt. orally) significantly decreased serum fructosamine, fasting blood glucose concentration, and glycosylated haemoglobin level. The liver enzyme activity also improved. The use of MC capsules in combination with insulin therapy and restricted fat high fiber diet would improve glycaemic control in naturally occurring diabetes mellitus.

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