

Study on Antidiabetic Effect of *Aloe vera* Extract on Alloxan Induced Diabetic Rats

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Abstract: The present work was carried out to investigate the antidiabetic effect of *Aloe vera* water extract in normal and alloxan induced diabetic rats. To investigate the effect of *Aloe vera* 40 albino rats were included in this study divided into four groups of ten rats in each group. Group A and B rats were normal while diabetes was induced in group C and D rats by intraperitoneal injection of alloxan dissolved in 1mL of distilled water at a dose of 125mg/kg body weight. The *Aloe vera* water extract was given orally at a dose of 150mg/kg of body weight. Data was taken after seven days of administration of alloxan. After the induction of diabetes the group B and D rats were treated with *Aloe vera* water extract at a dose of 150mg/kg of body weight. Group A and C rats were not treated with *Aloe vera* water extract. The blood samples were taken from the coccygeal vein of each rat for the estimation of glucose level at different time periods i.e. 30 and 45 days after the treatment. After 30 days of treatment with plant extract 5 animals of each group were decapitated. The other 5 animals were kept for 15 days without any additional treatment as a recovery period. All the samples were analyzed for blood glucose level by using enzymatic kits. The blood glucose level of treated groups of rats showed significant reduction after 30 days of treatment with *Aloe vera* water extract. By statistical analysis of results it was found that *Aloe vera* water extract has antidiabetic effect in normal and alloxan induced diabetic rats.

Key words: Albino rats % Alloxan % *Aloe vera* % Antidiabetic effect

INTRODUCTION

Diabetes mellitus is a disorder of carbohydrate metabolism in which sugars in the body are not oxidized to produce energy due to the lack of pancreatic hormone insulin. Type I diabetes starts in childhood or adolescence is more severe than type II develops in younger people [1]. Type I diabetes represents a heterogeneous and polygenic disorder, with a number of non-HLA loci contributing to disease susceptibility [2]. Type I diabetes accounts for 5 to 10% of all cases yet there is no identified agent substantially capable of preventing this type of disease [3]. Type II diabetes accounts 90 to 95% of all diabetic patients and treatment is complicated by several factors inherent to the disease process, typically insulin resistance, hyperinsulinemia, impaired insulin secretion, reduced insulin-mediated glucose uptake and its utilization [4-6]. The treatment of diabetes mellitus has been attempted with various

indigenous plants and polyherbal formulations [7-9]. Encouraging results have been obtained from plant extracts with respect to antidiabetic activity, but still only a meager percentage of the plant world has been explored [10].

Medicinal plants like *Trigonella foenum graecum*, *Allium sativum*, *Gymnema slyvestre*, *Syzygium cumini* and *Aloe vera* have been studied for treatment of diabetes mellitus [11]. Herbal extracts have been confirmed for its hypoglycemic effect in human and animals for type II diabetes [12]. *Aloe vera* is a cactus-like plant with green, dagger-shaped leaves that are fleshy, tapering, spiny, marginated and filled with a clear viscous gel [13]. Extracts of *Aloe* gum increases glucose tolerance in both normal and diabetic rats [14] and *A. vera* sap taken for 4-14 weeks has shown a significant hypoglycaemic effect both clinically and experimentally [15]. The present work was carried out to study the antidiabetic effect of *A. vera* extract on healthy and diabetic rat models.

MATERIALS AND METHODS

Place of Work: The whole experimental work was carried out at the Institute of Molecular Biology and Biotechnology, The University of Lahore, Lahore.

***Aloe vera* (Kawar Gandal):** Specimens of *Aloe vera* were collected from local market. Fresh leaves of this cultivated plant were used in this study.

Alloxan: Alloxan induced hyperglycemia has been described as a useful experimental model to evaluate the activity of hypoglycemic agents [14]. Diabetes was induced by a single intra-peritoneal injection of alloxan prepared in 0.1mol/L citrate buffers at a dose of 100 mg/Kg body weight. Diabetes was confirmed in the alloxan treated rats by measuring the fasting blood glucose concentration 8-10 days post-injection [16].

Enzymatic Kit: Commercial kits of the company Human, Germany were used to determine serum glucose levels in albino rats by spectrophotometer.

Animals: Forty adult male albino rats (weighing 200-300 g) were used and housed in stainless steel cages with wire mesh floor.

Induction of Diabetes: The animals were divided into four groups and each group consisted of ten rats. Diabetes mellitus was induced in overnight fasted animals by a single subcutaneous injection of alloxan in a dose of 120mg/kg body weight dissolved in 0.5ml acetate buffer (pH 5.5) prepared immediately before use. After 7 days of alloxan injection, the level of glucose was measured [17]. Rats with serum glucose level, ranging between 150 mg/dl or above were considered as diabetic.

Preparation of Extract: The aqueous extract was prepared by boiling 100 gms of the plant with 200 ml dist. water for 10 min. After cooling to room temperature, the extract was filtered and stored in refrigerator.

Administration of Sample: The dose (½ ml/100 gm body weight) was orally administered for 30 days daily. After 30 days of treatment with plant extract 5 animals of each group were decapitated. The other 5 animals were kept for 15 days without any additional treatment as a recovery period.

Samples Collection and Analysis: Blood (1ml) was collected from coccygial vein of each rat and was transferred into sample tubes for analysis. The serum was obtained by centrifuging each blood sample at 3000 rpm for 10 minutes. The specific enzymatic kit was used to assess the serum glucose levels of rats using spectrophotometer [18].

Estimation of Blood Glucose: Glucose is determined after enzymatic oxidation in the presence of glucose oxidase. The hydrogen peroxide formed reacts, under catalysis of peroxidase, with phenol and 4-aminophenazone to form a red-violet quinoneimine dye as an indicator.

Procedure: Total 42 test tubes were taken. 40 tubes were labeled as 1, 2, 3 ...40 for each sample of rat's serum from each group i.e., normal + normal feed, normal + *Aloe vera* extract, diabetic + normal feed and diabetic + *Aloe vera* extract. The remaining two tubes were labeled as blank and standard. 2ml reagent was taken in all the tubes by pipette. 20µl of distilled water was added to the test tube labeled as blank, 20µl of standard solution from the kit was added to the test tube labeled as standard and 20µl of each serum sample was taken in tubes labeled as 1,2,340. Then the contents of all tubes were mixed and incubated at 37°C for 10 minutes. Then absorbance of standard (Abs Std) and sample (AbsS) were measured at 546nm against the blank (AbsRB).

Calculation: Glucose concentration (mg/dl) = (Abs test/ Abs Standard) × 100 [19]

RESULTS

The present work was designed to investigate the antihyperglycaemic effects of *Aloe vera* extract in Alloxan-induced diabetic albino rats.

The diabetic group showed marked increase of glucose level as compared to the normal ones as shown in figure 1. The average blood glucose levels of group A, B, C and D were recorded as 109.1, 92.4, 172 and 138.7 mg/dl after 30 days of experiment, respectively (Figure 1).

The diabetic group C showed slightly increase of blood glucose level during the recovery period as shown in figure 2. No increase or decrease of blood glucose levels was observed during recovery period in group as shown in figure 2. A slightly decrease in blood glucose level was observed in group B and D which were treated with *Aloe vera* extract for 30 days.

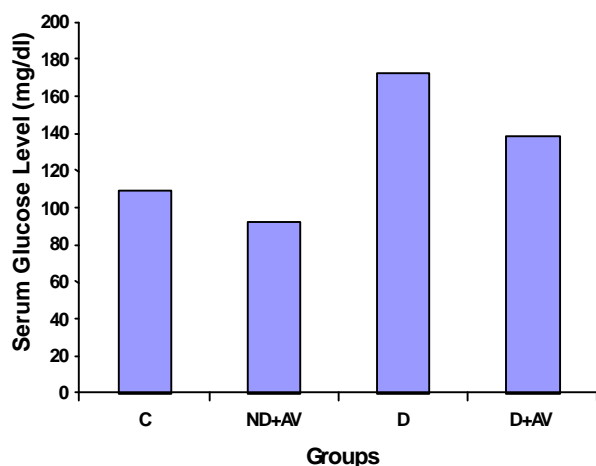


Fig. 1: Evaluation of Serum Glucose Level after 30 Days [C = Control, ND+AV = Non Diabetic + Aloe Vera, D = Diabetic, D+AV = Diabetic + Aloe Vera]

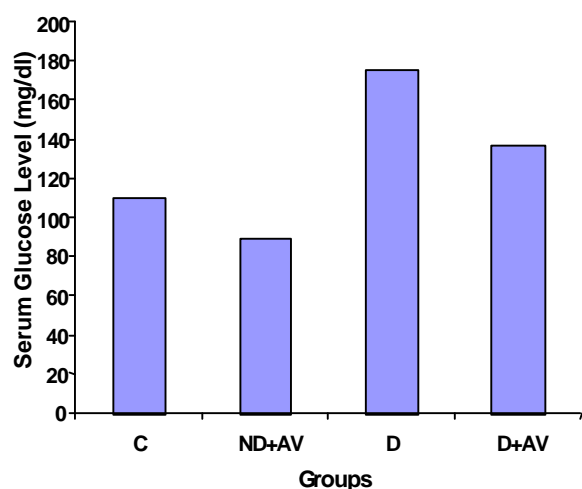


Fig. 2: Evaluation of Serum Glucose Level after 45 Days [C = Control, ND+AV = Non Diabetic + Aloe Vera, D = Diabetic, D+AV = Diabetic + Aloe Vera]

DISCUSSION

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia and alterations in carbohydrate, fat and protein metabolism, associated with absolute or relative deficiencies in insulin secretion or insulin action [20].

The present work was designed to investigate the antihyperglycaemic effects of *Aloe vera* extract in Alloxan-induced diabetic albino rats. Blood analysis was done to observe the change in blood glucose levels of the rats at different time periods i.e. 30 and 45 days after the treatment.

The present study demonstrated that after the 45 day of treatment diabetic and non-diabetic rats had significant effect of *Aloe vera* on their blood glucose levels. Glucose levels of diabetic and non diabetic rats of Group A, B, C and Group D decreased as shown in figures 1 and 2. When the blood glucose levels of the rats to which *Aloe vera* extract was administered was compared to the control group rats it was discovered that the administration of *Aloe vera* extract tend to bring the blood glucose levels of diabetic rats towards the normal level. The results are highly correlated with the work of Eman *et al.* [21] who reported that the aqueous bark extract of *Aloe vera* exhibited effective antihyperglycemic action in diabetic and normal rats. Significant effect of *Aloe vera* on the blood glucose levels of rats is also in agreement with the work of Ayse *et al.* [22]

In group A which is non diabetic control group no increase or decrease in blood glucose level was observed as shown in figure 1 and 2. These findings are correlated with the work of Olusola *et al.* [23] showed that there is no increase or decrease in blood glucose level.

Non diabetic group B rats received the *Aloe vera* extract showed a significant decrease in blood glucose levels as shown figure 1 and 2. These findings are correlated with the work of Eman *et al.* [21] and Ayse *et al.* [22] who observed a significant decrease in blood glucose level occurred because this group rats were treated with plant extract.

Average increase in blood glucose levels was observed in group C rats which are diabetic control group. These findings are correlated with the work of Olusola *et al.* [23]. A significant decrease in blood glucose levels was observed in group D rats which were administrated *Aloe vera* extract. These findings are correlated with the work of Eman *et al.* [21], Ayse *et al.* [22] who showed that there is significant decrease in blood glucose levels occurred because the rats of this group were treated with plant extract.

CONCLUSION

The present research work revealed that the administration of *Aloe vera* extract showed antidiabetic effects in alloxan induced diabetic rats, therefore it was concluded that *Aloe vera* extract is helpful to lower glucose level in treatment of diabetic patients.

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