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Research Article

EVALUATION OF HYPOGLYCEMIC EFFECT OF ALOE VERA ON ALLAXON INDUCED DIABETIC RATS

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ABSTRACT

Aloe vera is used worldwide for several medical purposes as alternative medicine The present study, is an attempt to evaluate the hypoglycemic effects of aqueous leaf extract of Aloe vera Alloxon injection(65mg /kg body weight) induced hyperglycemia, Oral administration of aqueous extract of Aloe vera at a dose of 0.5ml /100gm body weight for a prolonged period (30days) significantly reduced blood sugar levels and rise in liver glycogen content in allaxon induced diabetic rats compared with control group. The treatment with aqueous extract of leaves also showed improvement in the body weight, food and water consumption in allaxon induced diabetic rats. Prolonged treatment of rats with Aloe extract did not show any toxic effect.

INTRODUCTION

Diabetes mellitus is a group of metabolic disorder which is characterized by hyperglycemia. This results from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia or diabetes is associated with long- term damage, dysfunction and failure of various organs, especially the eyes, kidney, nerves, hearts and blood vessels (American Diabetes Association, 2004). Hyperglycemia and hyperlipidemia are two important characters of diabetes mellitus in which diabetic patients experience various vascular complications such as atherosclerosis, coronary heart disease, diabetic retinopathy, nephropathy and neuropathy (Sheetz, 2002). Several hypotheses have been put forward to explain the genesis of diabetes. These include auto oxidation processes of glucose, the non-enzymatic and progressive glycation of proteins with the consequently increased formation of glucose-derived advanced glycosylation end products, and enhanced glucose flux through the polyolpathway (Tiwari, 2002). Though many modern medicines are available to control diabetes but many of them are having severe side effects. Management of diabetes without any side effect is still a challenge to the medical system.

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This lead to increasing demand for natural products with antidiabetic activity and lesser side effects. Many herbs and plant products have been shown to have anti diabetic property. Aloe vera is one of these plants with anti diabetic property (Grover *et al*., 2002). Aloe vera, commonly known as aloe or Gwar patta (Hindi), is belonging to the family Asphodelaceae or aloe family. The biological activities of Aloe vera include wound healing, antifungal activity, hypoglycemic or antidiabetic effects, anti inflammatory, anticancer, immunomodulatory and gastro protective (Hamman, 2008). The plant is a store house of many phytochemicals, vitamins, nutrients and anti-oxidants (Maenthalsong, 2007). Fresh aloe juice from the inner leaf parenchyma contains 96% water, polysaccharides (mucilage). The main constituent of this mucilage are D-glucose and D-mannose, tannins, steroid, enzymes, plant hormones, amino acids, vitamins and minerals (Samulsson, 2004). Many of the health benefits associated with Aloe vera have been attributed to the polysaccharides contained in the gel of the leaves

MATERIALS AND METHODS

Plant Material

Fresh leaves of Aloe vera were used in the present study were collected from the garden of St.Thomas college The aqueous

extract of Aloe vera leaves was prepared by boiling 500 gms of leaves in 1 Liter distilled water for 10 min. After cooling to room temperature, the extract was filtered and stored in refrigerator (Helal *et al*., 2003). The experimental animals were supplied with 0.5ml per 100gm body weight aqueous leaf extract orally for 30 days

Animals

Albino rats (200-350 gm) of both sexes were obtained from a commercial supplier. Before and during the experiment rats were provided with free access to food and water. Efforts were made to minimize animal suffering and to reduce the number of animals. All experiments complied with guidelines on ethical standards, for the investigations in animals. The study was approved by Institutional animal ethical committee for the care and use of animals. After randomization in to various groups and before initiation of experiments rats were acclimatized for a period of 7 days under normal laboratory conditions of temperature, humidity, dark and light cycles. Care has been taken to give the leaf extract at a fixed time in the morning hour (10AM).

Experimental design: Groups of animals five in each received following treatment schedule

- **Group I** Normal control (non diabetic)
- **Group II** Non diabetic + Aloe extract
- **Group III** Allaxon treated rats (without leaf extract or diabetic control)
- **Group IV** Allaxon treated rats + Aloe extract

Control group of both diabetic and non diabetic received only distilled water during the period of experiments.

Induction of diabetes

Diabetes mellitus was induced in overnight fasted animals by a single intraperetoneal injection of alloxon (at a dose of 60mg/kg body weight) (Allaxon hydrate, CDH, India) Allaxon was weighed, and then dissolved in saline just prior to the injection. Hyperglycemia was observed in rats after two days. Rats with plasma glucose level >or= to160 mg/dl were selected for the present study. Treatment with aqueous leaf extracts was started 48 hour after allaxon injection.

Collection of Blood Samples and Blood Glucose determination

For monitoring the blood glucose the blood samples were collected from tail tip of rat at the interval of seven days till the end of the experiment. The blood glucose was monitored by using one touch glucometer (One Touch select simple Life Scan India) using glucose test strips. The animals were sacrificed after 7, 15 and 30 days under mild ether anesthesia. Blood samples and muscle and liver tissues were collected and proceeded for glucose (Nelson, 1952) and glycogen estimation (Mukherjee, 2005). Statistical Analysis: All values of body weight, blood sugar ,muscle and liver glycogen were expressed as mean± Standard error of mean (SEM) and analyzed for ANOVA Differences between groups were considered significant at $P<0.05$ levels

RESULTS

Intraperetoneal administrations of allaxon (60mg/Kg) led to an increase in blood sugar level, which was maintained for one week. The control group of animals (non diabetic) did not show any significant changes in consumption of waterand food. Significant changes are not observed in body weight and blood sugar level. (Table 1, Figure 1). The Animals of the diabetic control group (Allxon treated rats without Aloe leaf extract) showed increase in food and water consumption. The body weight of this group of animals showed significant reduction. There is an elevated blood sugar level in this group of animals (Table 1, Figure 1). Normal rats (without Allaxon treatment) with aloe leaf extract did not show any change in the food and water consumption and body weight. Significant changes are not seen in the blood sugar level of this group of animals (Table 1, Figure 1)

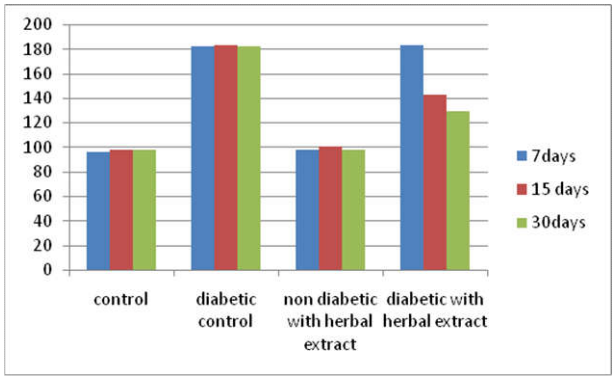

Fig. 1 blood sugar level in non diabetic and diabetic rats

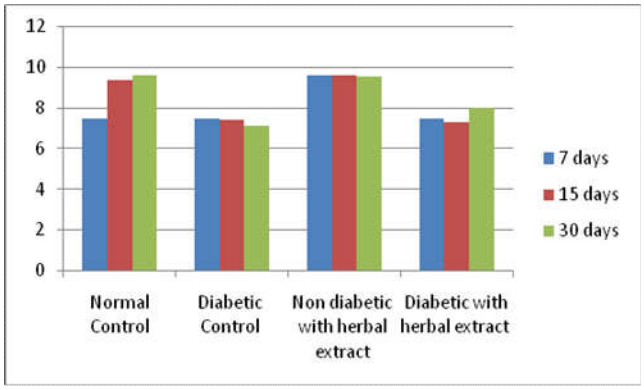

Fig. 2. muscle glycogen in non diabetic and diabetic rats

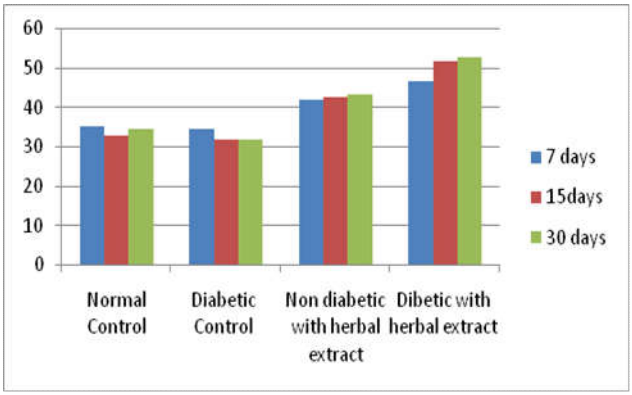

Fig. 3. liver glycogen in non diabetic and diabetic rats

Table 1. Body weight and blood sugar level in non diabetic and diabetic rats

	Body weight (gms)			Blood sugar (mg/100ml)		
	7days	15 days	30 days	7 days	15 days	30 days
Control(only d.w)	330±1.22	329±0.45	331±0.20	96.40±0.89	98.60±0.40	98.4±0.40
Diabetic control (Allaxon + d.w)	320±0.55	296.80±0.73	294.40±1.47*	183±0.37	184±0.21	183±0.35*
Normal rats with only herbal extract	330±1.2	330±0.45	331.20±0.84	98.60±0.40	101.20±0.37	98.40±0.40
Diabetic rats with herbal extracts	296±0.73	302±0.32	320±0.55*	183.80±0.37	143.40±1.03	129.60±0.75*

*P<0.5 n=5

Table 2. Muscle and liver glycogen in non diabetic and diabetic rats

	Muscle glycogen (mg/100gm)			Liver glycogen (mg/100gm)		
	7days	15 days	30 days	7 days	15days	30 days
Control (Only distilledwater	7.5±0.10	9.4±0.15	9.64±0.11	35.40±0.16	33±0.31	34.60±0.51
Diabetic control (Allaxon + d.w)	7.5±0.100	7.42±0.86	7.10±0.17	34.5±0.16	32±0.31	32±0.25
Normal Rats (with Herbal Extact)	9.6±0.08	9.6±0.07	9.54±0.04	42±0.31	42.60±0.07	43.32±0.40
Diabetic rats with herbal extracts	7.46±0.29	7.32±0.05	8.04±0.11*	46.80±0.10	52±0.32	52.80±0.86*

*P<0.05 n=5

The Diabetic rats (Allaxon treated rats) treated with aqueous leaf extract of Aloe vera showed marked decrease in water and food consumption During the initial period of experiment the rate of consumption was more this gradually reduced by the end of the experiment. Significant changes are seen in body weight. Decreased body weight is seen in this group of animals up to 7days of experiment. The body weight showed gradual increase by 15th day and significant increase is observed by 30th day of treatment (Table 1). The diabetic rats treated with aqueous leaf extract of Aloe vera showed significant changes in the blood sugar level. Increased blood sugar level was seen in the initial periods of the experiment(up to 7th day), but significant decrease was observed in blood glucose level of diabetic rats treated with aqueous leaf extract of Aloe vera for 30 days when compared with control group of animals (Table1,figure 1). Significant changes are not seen in muscle and liver glycogen content of control group of animals (Without any treatment) Similar results are seen in the group of animals treated only with herbal extract (Non diabetic + herbal extract). (Table 2, Figure 2 and 3). The glycogen content of the muscle and liver did not show any significant change in diabetic control rats (Allaxon treated rats Without herbal extracts) (Table 2, figure 2 and 3). Allaxon induced diabetic rats treated with aqueous leaf extract showed significant increase in muscle and liver glycogen content (Table 2, figure 2 and 3)

DISCUSSION

The present study demonstrated that single injection of alloxan induced a decrease in body weight, hyperglycemia associated with decreased liver glycogen and inhibition of pancreatic B-cell activation. The decrease in body weight following alloxon injection is in agreement with previous study (Helal, 2003; Rungby, 1992). It may be due to different side effects of inability to use carbohydrates including lypolysis, acidosis (Ganong, 1995). The hyperglycemia and decrease in liver glycogen content observed in diabetic group are due to lack of insulin, increased gluconeogenesis and or glycogenolysis (Masahi, 1979; Defronzo, 1992). Such suggestions agree with the present results, which indicated decrease and inhibition of pancreatic B-cells activities of alloxon diabetic animals. In support of this, studies reported that alloxon has a destructive cytotoxic effect. In all rats that were treated with Aloe vera extract the blood glucose level decreased significantly by 30th day indicating a positive effect of Aloe vera leaves extract in reducing diabetes.

This effect may be due to release of insulin or through any other mechanism involving glucose utilization. These results are similar with the findings of (Helal, 2003) that showed that the extract of Aloe vera has hypoglycemic effects. Similar results are also been reported by (Can *et al*., 2004; Rajasekaran *et al*., 2004). According to these authors the Aloe vera extract has a beneficial effect in reducing hyperglycemia. The present results indicate of that treatment with Aloe vera attenuated the alloxon induction of hyperglycemia, improved the decrease in body weight, increased the liver glycogen and improved pancreatic B-cells activities. Aloe vera extract contain high calcium level (Blumenthal *et al*., 1998).

As it is suggested by earlier authors decreasing hyperglycemia by Aloe vera may be due to the increase in calcium level (Login *et al*., 1985; Terao *et al*., 1989) which in turn stimulates the B-cells of pancreas, that lead to an increased secretion of insulin and to increase liver glycogen level (Abu-Sinna *et al*., 1993; Abu-Amra, 1994). This is supported by different authors (Fyles *et al*., 1986). Some reported that the stimulation of B- adrenergic receptors on the islets of Langerhans increases insulin secretion. Also, insulin stimulates the metabolism which increases glycogenesis and glycolysis (Malhoero, 1980). The results of the present study also support the earlier findings. The cellular growth is controlled by several factors, such as insulin, insulin like growth factors and nerve growth factors (Karp, 1984). It is suggested that the activation of pancreatic B-cells of diabetic rats by Aloe vera aqueous extract could be attributed to Aloe vera constituents who may contain some growth factors and or a component with insulin like effect, which in turn inhibits epinephrine induced lipolysis and decreased body weight. Moreover, it may be that Aloe vera aqueous extract may have an active ingredient which can stimulate and help in the recovery of the injured B-cells induced by alloxon.

Conclusion

The results of the present study indicate that aqueous leaf extract of Aloe vera could be useful and safe agent in reducing hyperglycemia induced by alloxan. More detailed studies on A. vera using different doses and prolonged periods of observation are needed before reaching a clear cut conclusion about the future of A. vera for the treatment of diabetes mellitus.

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