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THE EFFICACY OF *ALOEVERA* EXTRACT ON LIVER CARBOHYDRATE METABOLIC PROFILES IN ALLOXAN INDUCED DIABETIC MALE ALBINO-RATS

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ABSTRACT

Aloe vera has been mentioned in Indian System of traditional medicine to be of value in the treatment of many diseases. The present study was undertaken to asseses the effect of *Aloe vera* on the Carbohydrate metabolic profiles in Alloxan induced diabetic rats. *Aloe vera* leaf get extract administered orally to different groups of rat at a dose of 300 mg/kg body weight. Four groups (n=6) follows, control rats, control + *Aloe vera*, diabetic rats (Alloxan 40mg/kg body weight), diabetic + *Aloe vera*. The parameters studied are total carbohydrates, glycogen and glucose. These metabolic profiles were decreased in diabetic rats and glucose increased. Whereas, with *Aloe vera* extract treatment in diabetic rats these carbohydrate metabolic profiles were increased and glucose decreased. The observed reductions in carbohydrate metabolic profiles during diabetic condition in liver tissue may be due to the alterations in the Carbohydrate metabolism. In conclusion the *Aloe vera* extract posses hypoglycemic property in diabetic rats, carbohydrate metabolic profiles were came to normalcy.

KEYWORDS: Diabetes, *Aloe vera,* Alloxan, liver, Carbohydrates metabolic profiles.

INTRODUCTION

The Diabetes causes loss of weight as if the body mass is passed through the urine. Although it was known for centuries that the urine of patients with diabetes was sweet, it was not until 1674 that physician named Willis coined the term diabetes mellitus from Greek word for honey.[1] Diabetes is the most common serious metabolic disorder and it is considered to be one of the give leading causes of death in the world.[2] In diabetes, major impairments in carbohydrate, fat and protein metabolisms occur.[3] The carbohydrate homeostasis depends on

the balance between their formation and their utilization by major peripheral tissues and is significantly altered during diabetes.[4] Plant derived products have been used for medical purposes for centuries.

At present, it is estimated that about 80% of the world population relies on botanical preparations as medicines to meet their health needs. Recent decades have shown a resurgent interest in traditional plant treatments for diabetes. Plants often contain substantial amounts of antioxidants including Alfa-tocopherol (vitamin-E), Carotenoids, ascorbic acid (vitamin-C) flavonoids and tannis.[5] *Aloe vera* is a perennial plant belonging to the family of Liliaceae, which includes about 360 species.[6] Taxonomists now refer to *Aloe* barbadensis as *Aloe vera.*[7] *Aloe vera* is a one of the few medicinal plants that has maintained its popularity for a long period of time. The plant has stiff gray-green lance-shaped leaves containing clear gel in central mucilaginous pulp. Clinical evaluations have revealed that the pharmacologically active ingredients are concentrated in both the gel and rind of *Aloe vera* leaves. Our previous experimental results were highly encouraging as they revealed that level of blood glucose was significantly lower after oral administration of ethanolic extract of *Aloe vera* gel in glucose load condition and in Alloxan induced diabetes.[8] Hence the present study was carried and out, the purpose of this investigation was to evaluate the effect of *Aloe vera* extract on Alloxan induces diabetes by measuring blood glucose levels and assaying the carbohydrate metabolic profiles in liver.

MATERIALS AND METHODS

Selection of Animals

Wistar strain albino rats (180±20g) were obtained from Indian Institute of science, Bangalore. The rats were housed in clean polypropylene cages having six rats cage and maintained under temperature controlled room (26±20C) with a photo period of 12 hours light and 12 hours dark cycle. The rats were fed with a standard rat pellet diet and water adlibitum. The study was carried out according to guidelines for the care and use of laboratory animals and approved by the Institutional Animal Ethical Committee at Sri Venkateswara University, Tirupathi, India. (Regd. No.438/01a/CPCSEA, Dt: 17-07-2001, and its resolution no. 08/2012-2013/ (i)/a/ CPCSEA/IAEC/SVU/MBR-MRN/dt. 02-07-2012).

Chemicals

The entire chemical used in the present study were Analar Grade (AR) and obtained from the following scientific companies: Sigma (ST. Louis, MO, USA), Fischer (Pitrsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India), Qualigens (Mumbai, India).

Induction of Diabetes

The rats were injected intraperitonial with Alloxan monohydrate (Span chemical Co.Mimbai) dissolved in sterile normal saline at a dose of 40 mg/kg body weight. After injection, they had a free access to food and water was given 5% glucose solution to drink, overnight to counter hypoglycemic shock. The animals were considered as diabetic, if their blood glucose values were above 250 mg/dl on the third day After Alloxan injection the treatment was continued for 21 days.

Preparation of *Aloe vera* extract

The fresh *Aloe vera* was locally and authenticated by botanist in the department of Botany, S.V.University, Tirupathi. *Aloe vera* solid gel in the center of the leaf was collected and homogenized resulting, mucilaginous, thick and straw colored homogenate was obtained and lyophilized. Then the lyophilized sample was extracted using 95% ethanol. The filtrate was collected and evaporated to dryness under reduced pressure in a rotary evaporator at 60°C. The residue was stored in dry sterilized small containers at 4°C until further use. A Suspension which is the form customarily usual in folk medicine was prepared by dissolving suitable amount of ethanol free extra of *Aloe vera* leaf gel to get the desired concentration. The dosing schedule used was once per day. The extracts were administered orally, daily to different groups of rat at a dose of 300 mg/kg body weight.

Experimental design

Rats were randomly divided into four groups of six animals in each group.

Group-1: Control rats

Group-2: Control + *Aloe vera* (300mg/kg body weight of *Aloe vera*)

Group-3: Diabetic rats (40mg/kg body weight of Alloxan)

Group-4: Diabetic + *Aloe vera* extract (300mg/kg body weight in ethanol solution daily. Once in a day by an intragastic tube for 21 days)

After completion of 21 days treatment the animals were sacrificed by cervical dislocation and the liver tissue was excised at 4°C .The tissue was washed with ice-cold saline, and immediately stored in deep freeze at 80° C for further biochemical analysis.

Statistical analysis

The data has been analyzed by using one-way Analysis of Variance (ANOVA) followed by Dunnet's-test and 'P' value < 0.001 was considered significant. The data were presented as Mean ± S.D. And analysis was carried out by using SPSS 16.0.1 program.

RESULTS

Total Carbohydrates

In control rats the amount total carbohydrate was found to be 50.61 mg of glucose/gm wet weight of tissue in liver. In group-II, where the control rats were treated with *Aloe vera* extract the levels were increased. Group-III had showed a significantly decreased to 35.03 mg of glucose/gm wet weight of tissue in liver. In group-IV where the diabetic rats were subjected to *Aloe vera* extract, increased levels were found when compared to control rats.

GLUCOSE

In control rats the amount glucose was found to be 1.41 mg of glucose/gm wet weight of tissue in liver. In group-II, where the control rats were treated with *Aloe vera* extract the levels were decreased. Group-III had showed a significantly increased to 1.77 mg of glucose/gm wet weight of tissue in liver. In group-IV where the diabetic rats were subjected to *Aloe vera* extract, decreased levels were found when compared to control rats.

GLYCOGEN

In control rats the amount glycogen was found to be 45.22 mg of glucose/gm wet weight of tissue in liver. In group-II, where the control rats were treated with *Aloe vera* extract the levels were increased. Group-III had showed a significantly decreased to 30.03 mg of glucose/g wet weight of tissue in liver. In group-IV where the diabetic rats were subjected to *Aloe vera* extract, increased levels were found when compared to control rats.

Table: Showing Glucose, Glycogen, and Total Carbohydrate levels in Liver the Control and Experimental animals

Parameter	**Group I** (Non Diabetic Rats)	**Group II** (Non Diabetic Rats + *Aloe vera*)	**Group III** (Diabetic Rats)	**Group IV** (Diabetic Rats + *Aloe vera*)
Glucose (mg of glucose/gm wet weight of tissue)	1.41±0.028	1.41±0.026 (-1.42)	1.78±0.027 (+25.58)	1.51±0.027 (+6.71)
Glycogen (mg of glucose/gm wet weight of tissue)	45.18±0.62	46.30±1.61 (+0.01)	30.03±0.53 (-56.93)	44.66±0.61 (-9.60)
Total Carbohydrates (mg of glucose/gm wet weight of tissue)	50.61±0.72	51.84±0.71 (+1.43)	35.03±0.68 (-39.88)	48.66±0.53 (-19.28)

Values are mean, ± S.D. of 6 individual rats

Values in the parenthesis are % change from that of control

Values are significantly difference from control at P < 0.001

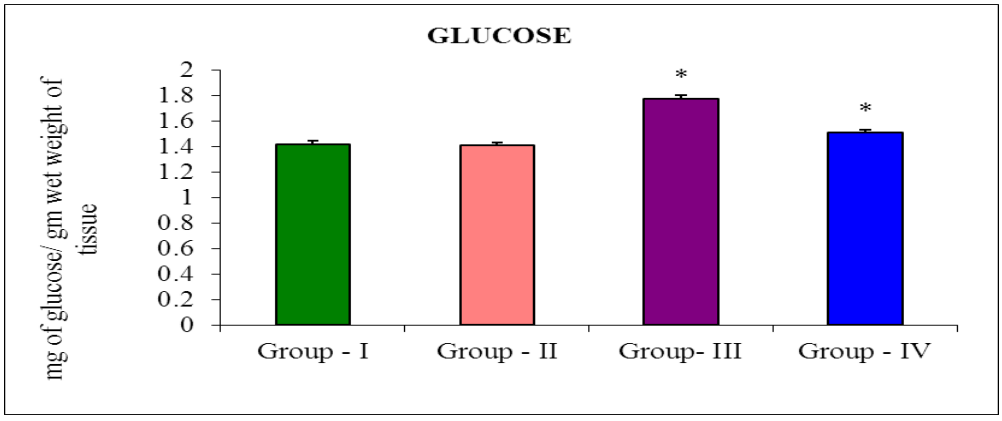

Fig: 1.1: Showing glucose levels in Liver tissue of control and experimental animals

* Significant difference from that of Diabetic Control animals P < 0.001.

Values are mean, SD: n=6

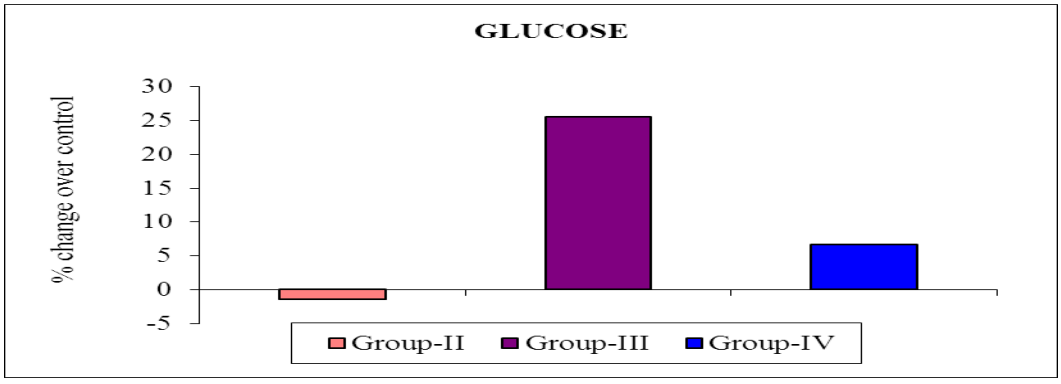

Fig: 1.2: Showing % change of glucose levels Liver tissue of control and experimental animals

Values in the parentheses are % change

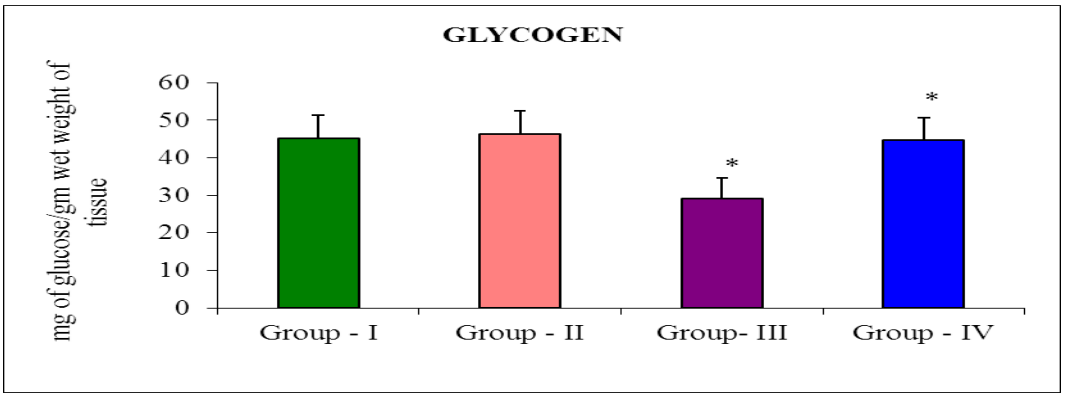

Fig: 1.3: Showing glycogen levels in Liver tissue of control and experimental animals

* Significant different from that of Diabetic Control animals P < 0.001.

Values are mean, SD: n=6

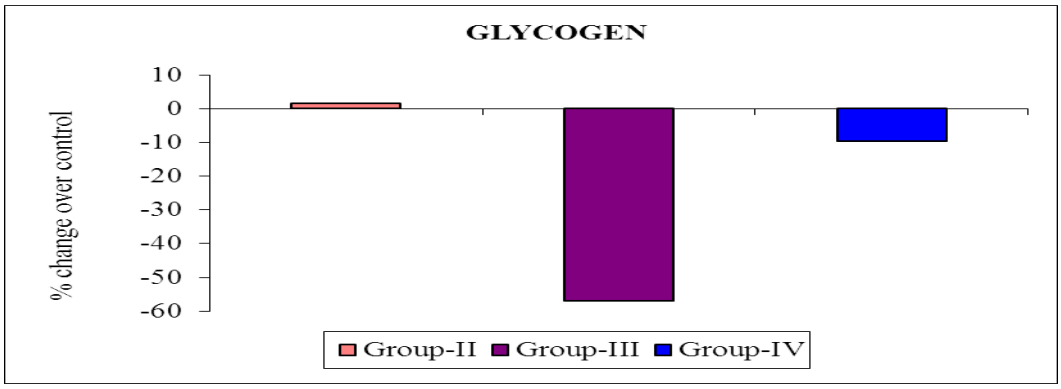

Fig: 1.4: Showing % change of glycogen levels in Liver tissue of control and experimental animals

Values in the parentheses are % change from Control

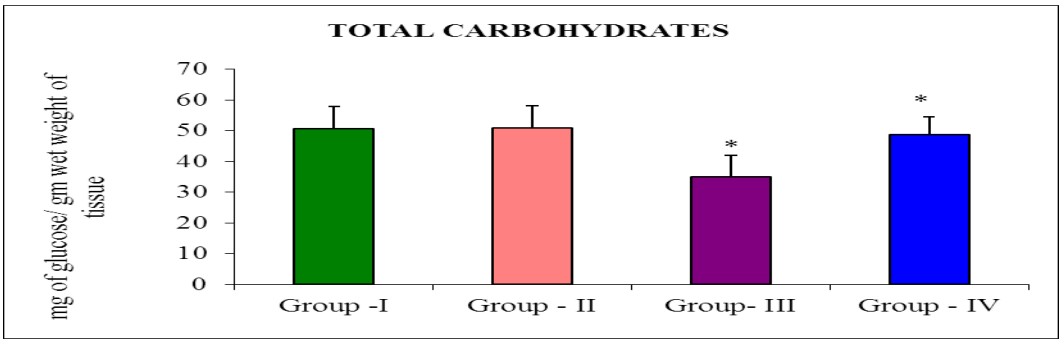

Fig: 1.5: Showing total carbohydrate levels in Liver tissue of control and experimental animals

* Significant difference from that of Diabetic Control animals P < 0.001.

Values are mean, SD: n=6

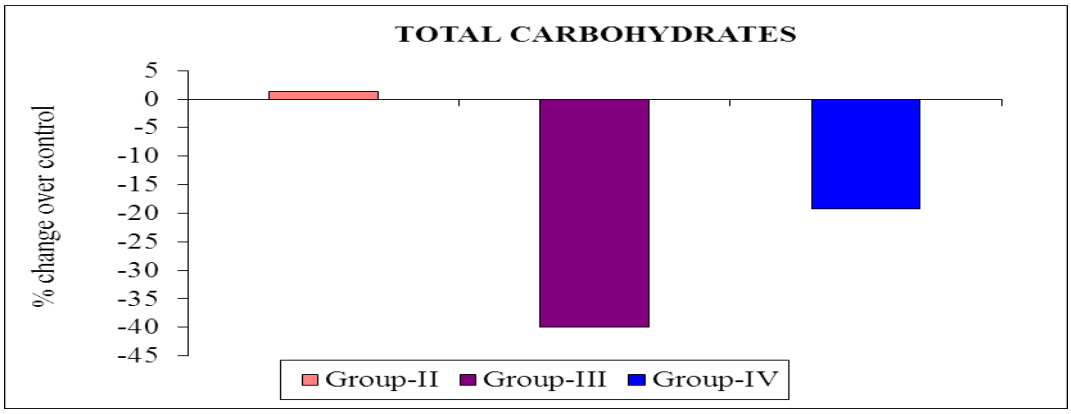

Fig: 1.6: Showing % change of total carbohydrate levels in Liver tissue of control and experimental animals

Values in the parentheses are % change from Control

DISCUSSION

The present study investigates the effects of *Aloe vera* on the carbohydrate metabolic profiles in Alloxan induced diabetic rats. Diabetes mellitus is characterized by reduced capacity of the Beta-cells in the pancreas, whether the cells are destroyed as in type-1.diabetes, to release sufficient insulin to induce the activity of glucose metabolizing enzymes.[9] Insulin increases hepatic glycolysis by increasing the activity and amount of several key enzymes including glucokinase, phospho fructokinase and pyruvatekinase.[10] One of the key enzymes in the catabolism of glucose is glucokinase, which phosphorylates glucose to glucose-6-Phosphate. The elevated blood glucose levels in diabetes are thought to lead to cell death through oxidative stress induction that occur as a common sequel of diabetes induced modification of sugar moieties on proteins and lipids.[11]

Carbohydrates are the major source of energy fuels for metabolic processes readily assimilable, though fats yield more energy. The carbohydrates serve as energy fuels for metabolic processes.[12] The abnormal regulation of glucose and impaired carbohydrate utilization that results from this defective and/or deficient insulin secretory response are the key pathogenic events in diabetes mellitus leading to the development and progression micro- and macro vascular complications which include neuropathy, nephropathy, cardio vascular and carebrovasular disease.[13] The significant decrease in total carbohydrate levels in the liver of diabetic rats suggests possible utilization of carbohydrates to meet the energy demand during Alloxan toxicity. Similar pattern of Changes in carbohydrate levels has been reported in brain and other tissues of make albino-rats during Alloxan induce diabetic condition.

Toxic compounds inhibit the formation of glucose from other compounds such as amino acids etc.[14]

Glycogen is the primary intracellular storable from of glucose and its levels in various tissues, especially in liver and skeletal muscles, are a direct reflection of insulin activity, which regulate glycogen deposition by stimulating glycogen synthase and inhibiting glycogen phosphorylase. The amount of glycogen present in tissues varied widely with diet and physiological status.[15] Glycogen is the major storage form of Carbohydrate in animals for biological function and the maintenance of the glycogen reserves in a important feature of the normal metabolism.[16] The entry of glucose in liver tissue is not dependent on action of insulin and, therefore, in the event of hyperglycemia there is an increase in the entry of glucose.[17] This has been postulated to cause increased liver glycogen deposition, which leads to glycosylation of basement membrane collagen in the liver.[18] In the present study oral administration *Aloe vera* extract to Alloxan induced diabetic rats regulated the activity of glycogen metabolizing enzymes by stimulating the remnant beta cells to secrete more insulin there by normalized the altered glycogen consent. Same results were observed in extract of seed of Tamarinds indica for 7 and 14 days in diabetic rats.[19] observed graded and significant elevation in liver glycogen levels. The glycogen contact was increased in liver, treatment with *Aloe vera* in Alloxan induced rats. Thus the obtained results focus the one possible way of antidiabetogenic action of *Aloe vera* extract by the improvement of glycogenesis process in liver.

CONCLUSION

The effect of the ethanolic of *Aloe vera* on liver tissue carbohydrates status due to reduction enzymes in activities of diabetic rats. Further studies are in progress in *Aloe vera* and thick role in controlling diabetes.

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