

## Evaluation of Therapeutic Efficacy of *Aloe vera* Sap in Diabetes and Treating Wounds and Inflammation in Animals

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**Abstract:** The experiment was conducted at Department of Inorganic Chemistry, University of Madras, Tamilnadu, India, to evaluate the therapeutic efficiency of *Aloe vera* sap in diabetic and treating the wounds and inflammation in animals. *A. vera* treated diabetic rats showed a marked increase in body weight, liver glycogen, decrease in blood glucose, urine sugar levels and serum lipids when compared to other groups. In wound healing experiment, the progress in the healing of the wound treated with phenolic anthraquinones of *A. vera* sap was faster than the untreated control.

**Keywords:** *Aloe vera* sap, therapeutic efficiency, diabetic, wound, inflammation, animals

### INTRODUCTION

*Aloe vera* L. (*Aloe barbadensis* Miller) is an important medicinal plant belongs to the family Liliaceae. It has larger demands and is traded in medicinal drug markets of the world for flavouring liquid and a source of 'aloin' (4.5 to 25 per cent). In recent times, herbal remedies are gaining their prominence, because of the observation that the efficacy of allopathic medicines such as antibiotics, which once had near universal effectiveness against serious infections is on the wane. Over the years, infectious agents have developed resistance to synthetic drugs and the herbs and their active constituents are now being increasingly used to treat various diseases. The ability of herbal medicine to affect body systems depends on the chemical constituents that it contains. Aloe products have long been used in health foods and for medical and cosmetic purposes. These products range from aloe drink to aloe gels, powders, capsules, creams etc. for both internal and external uses for a wide variety of indications. Aloe has a wide range of medicinal application such as wound healing effect, reduces blood sugar in diabetes, soothes burns, eases intestinal problems, reduces arthritic swelling, ulcer curative effect, stimulates immune response against cancer etc. Anthraquinones derivatives in *Aloe vera* gel play an important role in the treatment of tumors, diabetes, ulcer and cancer. *A. vera* appears to speed up the healing of damaged epithelial tissue in burns by providing essential micronutrients, an anti-inflammatory effect through the stimulation of skin fibroblasts [5]. Keeping the above facts in view, the present study was

conducted to find out the activity of *A. vera* sap in animals.

### MATERIALS AND METHODS

The study was carried out at Department of Inorganic Chemistry, University of Madras, Guindy campus, Tamilnadu to evaluate the therapeutic efficiency of *A. vera* sap in diabetic and treating the wounds and inflammation in rabbits. Evaluation of the therapeutic efficacy of *A. vera* sap in the treatment of diabetes (Anti-Diabetic Activity) was done by the grouping of the animals as follows. Group-1 (Normal Control), Group-II (Diabetic Control), Group-III (Diabetic rabbits treated with *A. vera* sap at 500g/kg/rabbit/day for 15 days), Group-IV (Diabetic rabbits treated with insulin (8 units/kg/day) for 15 days). After 15 days of treatment, the change in body weight, fasting blood glucose and urine sugar, serum lipid profiles, liver glycogen and vital enzymes including the enzymes of carbohydrate metabolism were determined by employing usual standard procedures. The therapeutic efficacy of *A. vera* sap in treating wounds and inflammation was evaluated by grouping the animals as follows. Group-I (Normal (both incision and excision)), Group II (Excision wound treated animals (2 x 4 cm<sup>2</sup>)), Group-III (Incision wound treated animals (2 x 2 cm<sup>2</sup>)). An excision wound was made by removing full thickness piece of skin from a pre-determined shaved area on the back of each rabbit. Experiments were designed and conducted as per CDCSEA and IAEC guidelines. The ointment used for topical application was formulated with 15 %

w/w of lyophilized *A.vera* leaf gel in soft white paraffin. The experimental animals were treated with *A.vera* gel ointment twice a day for 15 days using sterilized cotton swabs. At the end of the treatment period, the granulation tissue from the wound was taken for collagen assay.

**RESULTS AND DISCUSSIONS**

All the treated animals significantly influenced by the *A. vera* sap. The change in body weight, fasting blood glucose, urine sugar (qualitative) and liver glycogen in the control and experimental group of animals are shown in Table-1. There was a significant decrease in body weight, liver glycogen level and significant raise in blood glucose and urine sugar levels in alloxan induced diabetic rabbits (Group II). Administration of *A. vera* or insulin resulted in increased metabolism of glucose. *A. vera* treated diabetic rats (Group III) showed a marked increase in body weight, liver glycogen level and decrease in blood glucose and urine sugar levels when compared to other experimental groups suggesting the hypoglycemic nature of *A. vera*. The activity of hexokinase, glucose-6-phosphatase, lactate dehydrogenase (LDH), acid phosphatases and decreased activity of hexokinase are shown in table 2. The increased activity of hexokinase, a rate limiting enzyme in the glycolytic pathway, which converts glucose to glucose-6-phosphatase is increased in the *A. vera* treated diabetic

rabbits when compared to other experimental groups. Increased activities of glucose-6-phosphatase and lactate dehydrogenase account for their lipogenic property, which leads to synthesis of fats from carbohydrates. *A. vera* treated groups showed a marked decrease in the activity of glucose-6-phosphatase and lactate dehydrogenase by inhibiting the endogenous synthesis of cholesterol when compare to insulin treated and untreated diabetic rabbits (Table 2). Diabetes and hyperlipidemia also causes cell damage by altering the cell membrane architecture, which results in enhanced activity of acid and alkaline phosphatases in diabetic controls. In *A. vera* and insulin treated groups (III & IV), the cell damage was altered and this lead to the decreased activity of acid and alkaline phosphatases. Oral administration of aloe extract might be useful adjunct for lowering blood glucose in diabetic patients as well as reducing blood lipid levels in patients with hyperlipidaemia<sup>[6]</sup>. This finding is line with the results of<sup>[3]</sup>. The wound healing experiment was carried out in two types. In the first type, the phenolic anthraquinones separated from the *A. vera* sap was topically applied over the wound for 15 days. The second type was untreated with phenolic anthraquinones of aloe sap. It was noticed that the progress in the healing of the wound treated with phenolic anthraquinones of *A. vera* sap was faster than the untreated wound. A 70% reduction of wound diameter was noticed in rabbit receiving

**Table 1:** Change in Body Weight, Blood Glucose, Urine Sugar and Liver Glycogen levels in normal and experimental group of animals

Groups	Change in Body Weight (g)	Fasting Blood Glucose (mg/100ml)		Liver Glycogen Mg/kg of Wet tissue	Urine Sugar
		Initial	Final		
Normal Control	+40.10±2.50	83.50±12.05	86.50±11.05	46.10±32.50	
Diabetic Control	-19.10±1.50*	229.10±11.50*	289.10±9.50*	19.10±2.50*	+++
Aloe vera treated diabetic	+14.50±3.50**	214.30±7.50	114.30±9.50*	41.50±3.50*	+
Insulin treated diabetic	-10.10±1.35**	220.60±18.30	120.40±7.30*	39.20±1.50*	+

Group 2 is compared to Group 1  
 Group 3 and 4 are compared to Group 2  
 \*P<0.001, \*\*P<0.01

**Table 2:** Effect of Aloe vera, Insulin on the activities of Hexokinase, Glucose-6- phosphatase and Serum LDH, Acid and Alkaline phosphatases (values expressed as mg/100mL serum are mean ± SEM of six rabbits in each group)

Groups	Hexokinase (µmol glucose phosphorylated/h/mg protein)	Glucose-6-Phosphatase(µmol phosphate librated/min/g protein)	Serum LDH(µmol pyruvatem/in/gprotein)	ACP(KA Units /1oomL Serum)	ALP(KA units 100 mL Serum)
Normal Control	0.160±0.02	0.166±0.004	0.126±12.20	3.7±0.8	10.5±2.3
DiabeticControl	0.082±0.04	0.342±0.008	164.20±18.5	6.2±1.20	20.4±4.3
Aloe treated diabetic	0.157±0.016	0.167±0.003	124.30±10.20	4.6±1.4	11.3±0.4
Insulin Treated diabetic	0.14±0.015	0.194±0.04	138.40±9.1	4.1±1.5	13.8±9.10

Group II is compared to Group I, Group III and IV are compared to Group II  
 \*P<0.001, \*\*P<0.01

*A.vera* sap. From the result it is evident that both incision and excision treated animals showed maximum collagen content than the normal animal. Collagen is the protein of extra cellular matrix and is the component which ultimately contributes to the wound strength <sup>[1]</sup>. The extract of Aloe gel has anti-inflammatory activity and suggested its inhibitory action on the arachidonic acid pathway via cyclooxygenase <sup>[2]</sup>. This was concomitance with the results of <sup>[4]</sup>. It may be concluded from the present study that the administration of *A. vera* sap significantly reduced the levels of fasting blood glucose, urine sugar, liver glycogen and serum lipids which are actually raised in alloxan induced diabetes. *A. vera* sap was also used in wound healing due to the presence of phenolic anthraquinones.

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