

## ORIGINAL ARTICLE

## EFFECT OF ALOE VERA GEL ON RAT MYOCARDIAL CONTRACTILITY, CHRONOTROPY AND CORONARY FLOW IN ISOLATED HEART

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## ABSTRACT

**Background:** Aloe vera L. (Syn.: *ALOE BARBADENSIS* Miller; Hindi: Ghikanvar; AV) is a cactus-like perennial plant belonging to family Liliaceae, consists of high content of phenolic compounds, glycosides (aloin), 1,8-dihydroxyanthraquinone derivatives (aloe emodin), beta-1,4 acetylated mannan, mannose-phosphate and alprogen glucoprotein. Review revealed that leaf exudates and mucilaginous gel of Aloe possesses anti-inflammatory, antifungal, antibacterial, anticancer, antioxidant, cytoprotective, cardiac stimulatory and immuno modulatory activities. Therefore in present study we studied the effect of aloe vera gel on contractile and other property of rat myocardium using isolated heart model.

**Methods:** A total of 24 male albino rats were divided into four groups, one control and three experimental of six animals each. Aloe vera extract an aqueous solution of aloe barbadensis was prepared by taking 10 gm of gel from the fresh leaf of aloe plant and dissolved in 100 ml of distilled water. The hearts were perfused with aqueous solutions of Aloe in doses of 100mg, 200mg, and 300mg/l of Kereb's solutions.

**Observation and Results:** Our results showed that there was no significant deference in baseline HR and force of contraction among control and experimental groups. aloe vera in dose of 200mg/l and 300mg/l of Kereb's-Henseleits solution was intervened showed highly significant change in force of contraction and coronary flow as compared in control.

**Conclusion:** Our study showed that aloe vera causes increase in myocardial force of contraction and coronary flow; therefore aloe vera may be cardio protective.

**Key words:** Aloe vera, Heart rate, Myocardial Contractility

## INTRODUCTION

Aloe vera L. (Syn.: *ALOE BARBADENSIS* Miller; Hindi: Ghikanvar; AV) is a cactus-like perennial plant belonging to family Liliaceae (sub-family of the Asphodelaceae), cultivated in warm climatic areas <sup>1</sup>. The plant has elongated pointed fleshy leaves consisting of two parts viz. an outer skin (green rind) and an inner pulp (colorless mucilaginous gel) widely used as healing plants in the history of mankind<sup>2</sup>. AV consists of high content of phenolic compounds, glycosides (aloin), 1, 8-dihydroxyanthraquinone derivatives (aloe emodin), beta-1, 4 acetylated mannan, mannose-phosphate and alprogen glucoprotein<sup>3</sup>.

Aloe vera is a medicinal plant that is claimed to have hypoglycemic effect with fewer side effects and less expensive without toxicity<sup>4</sup>. The hypoglycemic efficacy of aloe gel was confirmed in streptozotocin-induced diabetic rats<sup>5</sup>. However, acute and sub chronic toxicity studies of aloe gel<sup>6</sup> showed no toxic effect when lyophilized aloe gel was administered orally to albino rats at

doses 1,4,16 or 64 mg/kg bodyweight twice daily, and the study revealed that the LD50 is over 5 g/kg body weight. Studies in mice showed no acute toxicity in therapeutic doses: however, in high doses a decrease of central nervous system (CNS) activity was observed <sup>7</sup>. No changes in levels of serum aspartate aminotransferase (AST), serum alanine aminotransferase (ALT), blood urea nitrogen (BUN) and creatinine were observed after administration of low dose aloe vera gel <sup>8</sup>. The oral administration of aloe vera gel extract at a dose of 300 mg/kg body weight per day to STZ-induced diabetic rats for a period of 21 days causes significant reduction in fasting blood glucose, hepatic transaminases (AST and ALT), plasma and tissue (liver) cholesterol, triglycerides, free fatty acids and phospholipids and a significant improvement in plasma insulin<sup>9</sup>. In another study it was found that the degenerative changes observed in the kidney tissue of streptozotocin-induced type 2 rats were diminished when they were given glibenclamide and aloe leaf gel and pulp extracts <sup>10</sup>. Aloe vera gel act as thromboxane A2 inhibitor, it

promotes vasodilatation and maintains hemostasis within the vascular endothelium as well as within the surrounding tissue <sup>11</sup>. In a study it was reported that verectin, a glycoprotein, indicated anti-oxidative, anti-thromboxane A2 synthase inhibition and cyclooxygenase-2 inhibiting activities in vitro <sup>12</sup>, those of which may be deeply correlated with vasodilatation in DM patients. Literature review revealed that leaf exudates and mucilaginous gel of Aloe possesses anti-inflammatory <sup>13</sup>, antifungal <sup>14</sup> antibacterial <sup>15</sup>, anticancer <sup>16</sup>, antioxidant <sup>17</sup> cytoprotective, cardiac stimulatory and immunomodulatory activities <sup>18</sup>. Therefore in present study we studied the effect of aloe vera gel on contractile and other property of rat myocardium using isolated heart model.

## MATERIAL AND METHODS

**Animals:** A total of 24 male albino rats weighing between 250-300 gm were divided into four groups, one control and three experimental of six animal each. Animals were housed in polypropylene cages and kept in a room that was maintained between 28-32°C. The light cycle was maintained and animals were fed with rat feed (Amrut Maharashtra), and water was given ad libitum. Animal experiments were conducted in accordance with the institutional ethics committee guideline for the conduct of the experiments on laboratory animals and as per guidelines of CPCSEA India.

**Aloe gel:** Aloe vera extract an aqueous solution of aloe barbadensis was prepared by taking 10 gm of gel from the fresh leaf of aloe plant and dissolved in 100 ml of distilled water. This solution was kept on vortex for 15 min and then solution was filtered and used for the study.

**Experimental protocol:** Animals of all the groups were anesthetized with Phenobarbitone (25 mg/kg body weight i.p.) Hearts were exposed through a left thoracotomy and the pericardium was removed. Heparin {100IU} was injected into the ventricles and the

hearts were quickly removed and placed in ice cold Kerb's -Henseleits solution of PH 7.4, Containing NaCl {118.0mmol/l}, KCl {4.7mmol/l}, CaCl<sub>2</sub> {2.5mmol/l}, mgSO<sub>4</sub> {1.0mmol/l} and NaHCO<sub>3</sub> {25.0mmol/l}. The Hearts were ice cold kreb's solution and then perfuse according to non-recirculation langendorff technique. Kerb's solution equilibrate with 95% O<sub>2</sub> +5% CO<sub>2</sub>, was delivered through and aortic cannula at 37°C under constant pressure of 60 mm Hg. Following perfusion, the hearts started beating spontaneously. All the hearts were perfused for 15 min to allow stabilization. Basal heart rate, the rate after each intervention and the force of contraction were recorded on physiograph [Bio Device, ambala, india]: coronary flow per minute was recorded by collecting the coronary effluent. The hearts of the experimental groups were perfused with an aqueous solutions al Aloe in doses of 100mg, 200mg, and 300mg/l of Kerb's solutions. The hearts were perfused with Kerb's solution to wash the preparation after each intervention. Data were analyzed using Student's test; P<0.05 was taken as indicating a significant deference.

## OBSERVATIONS

Our results showed that there was no significant deference in baseline HR and force of contraction among control and experimental groups. The heart rate in isolated heart in control and experimental group I, II, III, was 145±3.50, 144.50±4.8, 145.8±5.6 and 146.30±2.90 respectively. The baseline force of contraction was almost same in all the groups (p<0.05). The aloe vera gel in dose of 100mg/l does not alter the force of contraction while in the experimental group II-III in which aloe vera in dose of 200mg/l and 300mg/l of Kerb's-Henseleits solution was intervened showed highly significant change in force of contraction as compared in control. The coronary flow per minute was significantly higher in experimental group II and III as compared to control.

**Table-1 Baseline parameters:**

HR(bpm)	Control	Experiment-I	Experiment -II	Experiment-III
HR	145.00±3.50	144.5±4.8	145.80±5.6	146.30±2.90
FC(in mm)	11.60±1.70	11.20±2.0	10.90±1.80	11.50±1.20
CF (in ml/m)	5.26±0.20	5.10±0.18	4.98±0.30	5.29±50

HR: Heart rate; FC: Force of contraction; CF: Coronary flow

**Table-2 Effect of aloe vera on various parameters:**

HR(bpm)	Control	Experiment-I	Experiment -II	Experiment-III
HR	140.20±4.50	141.25±3.0	140.80±3.5	142.30±5.50
FC(in mm)	11.50±1.80*	11.60±1.50	14.50±2.28*	16.50±1.38*
CF (in ml/m)	5.23±0.18*	4.95±0.50	6.50±0.85	9.45±0.75*

HR: Heart rate; FC: Force of contraction; CF: Coronary flow; \* P<0.05

## DISCUSSION

Present study has been planned to elucidate the effect of aloe gel on heart myocardium using non re-

circulating isolated heart perfusion system. Our data suggests that aloe vera does not alter the HR in any experimental group while the force of contraction was

raised in experimental group- II and experimental-III. The sympathetic stimulation causes secretion of norepinephrine which may cause increase in force of contraction as well as HR <sup>19</sup> in our study the aloe vera does not increase the HR while the force of contraction increases significantly; it reveals that aloe vera may not work through sympathetic system. Inhibition of A1 & A2 adenosine receptors cause increase in intra cellular calcium and in turn increase the myocardial force of contraction. Although this study does not able to show any definitive mechanism for increase of force of contraction but we can speculate that aloe vera may inhibit A1 & A2 adenosine receptor to increase the myocardial force. It has been reported that aloe vera cause vasodilatation <sup>11</sup>.this vasodilatation may be due to endothelial secretion of nitric oxide. The increase in coronary flow in response to aloe vera, in our study, may be due to endogenous secretion of nitric oxide.

## CONCLUSION

Our study showed that aloe vera causes increase in myocardial force of contraction and coronary flow; therefore aloe vera may be cardio protective and will be helpful in reestablishing the ischemic myocardium.

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