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# Protective Effect of *Aloe vera* on Biochemical Parameters (Blood Glucose, Plasma Protein, and Serum Cholesterol) in Alloxan-Induced Diabetic Mice

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## ABSTRACT

Diabetes mellitus, a global metabolic disorder, is characterized by chronic hyperglycemia and alterations in carbohydrate, protein, and lipid metabolism. This study evaluates the protective effects of *Aloe vera* on key biochemical parameters—blood glucose, plasma protein, and serum cholesterol—in Alloxan-induced diabetic mice. Mice were divided into four groups: control, diabetic control, *Aloe vera*-treated diabetic, and standard drug (glibenclamide)-treated diabetic. After 21 days of treatment, *Aloe vera* administration significantly reduced blood glucose and serum cholesterol while improving plasma protein levels, indicating its potential antidiabetic and hypolipidemic properties. These findings support the therapeutic use of *Aloe vera* in managing diabetes-related complications.

***KEYWORDS:*** *Aloe vera, Diabetes Mellitus, Alloxan, Blood Glucose, Plasma Protein, Serum Cholesterol, Mice*

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## 1. INTRODUCTION

Diabetes mellitus is one of the most prevalent chronic diseases worldwide, currently affecting more than 537 million adults globally and projected to reach 643 million by 2030 (IDF Diabetes Atlas, 2021). It is characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association, 2022). The long-term consequences of uncontrolled diabetes include complications such as nephropathy, retinopathy, cardiovascular diseases, and neuropathy (Goyal & Jialal, 2022).

Biochemical markers such as blood glucose, plasma protein, and serum cholesterol are critical indicators for monitoring diabetes and its associated metabolic derangements. Hyperglycemia leads to increased oxidative stress and glycation of proteins, impairing their function (Brownlee, 2005). Simultaneously, diabetic dyslipidemia is marked by elevated cholesterol and triglycerides due to altered lipid metabolism (Chahil & Ginsberg, 2006). Moreover, plasma protein levels may decline in uncontrolled diabetes due to impaired protein synthesis and increased catabolism (Ali et al., 2020).

In recent years, attention has turned towards medicinal plants as alternative or complementary approaches for diabetes management. *Aloe vera* (*Aloe barbadensis Miller*), a succulent plant traditionally used for its wound-healing and anti-inflammatory properties, has been explored for its hypoglycemic and antioxidant activities (Yagi et al., 2009). Phytochemicals such as anthraquinones, flavonoids, and polysaccharides in *Aloe vera* have been reported to modulate glucose metabolism and lipid profiles (Rajasekaran et al., 2006).

Alloxan, a toxic glucose analogue, selectively destroys insulin-producing β-cells of the pancreas, thereby inducing diabetes in experimental animals (Szkudelski, 2001). Alloxan-induced diabetic mice serve as a widely accepted model for evaluating the efficacy of antidiabetic agents.

This study aims to investigate the protective effects of *Aloe vera* on blood glucose, plasma protein, and serum cholesterol in Alloxan-induced diabetic mice. The outcomes may help in validating traditional claims and elucidating the therapeutic role of *Aloe vera* in diabetes management.

## 2. Materials and Methods

### 2.1. Animals

Healthy adult Swiss albino mice (25–30 g) were procured and housed under standard laboratory conditions with 12-hour light/dark cycles. Mice had free access to water and standard pellet diet. Ethical clearance was obtained as per CPCSEA guidelines.

### 2.2. Induction of Diabetes

Mice were fasted overnight and injected intraperitoneally with Alloxan monohydrate (150 mg/kg body weight) dissolved in normal saline. After 72 hours, mice with blood glucose levels >200 mg/dL were considered diabetic and selected for the study (Lenzen, 2008).

### 2.3. Preparation of *Aloe vera* Extract

Fresh *Aloe vera* leaves were washed, peeled, and the gel was homogenized. The gel was lyophilized and reconstituted in distilled water for oral administration.

### 2.4. Experimental Design

| Group | Description | Treatment |
|---|---|---|
| I | Normal control | Vehicle only |
| II | Diabetic control (Alloxan) | No treatment |
| III | Diabetic + *Aloe vera* (150mg/kg/day) | Oral for 21 days |
| IV | Diabetic + *Aloe vera* (300 mg/kg/day) | Oral for 21 days |

### 2.5. Biochemical Parameters

- **Blood Glucose**: Estimated using Glucose Oxidase-Peroxidase method.
- **Plasma Protein**: Estimated using Biuret method (Gornall et al., 1949).
- **Serum Cholesterol**: Estimated by Zak's method (Zak et al., 1954).

### 2.6. Statistical Analysis

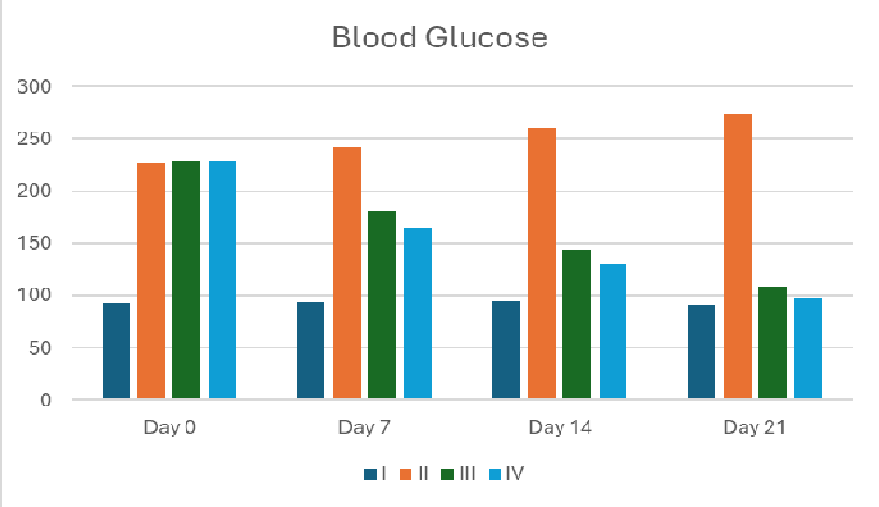
Results are expressed as mean ± SEM. Statistical significance was determined using one-way ANOVA followed by Tukey's post hoc test. A value of $p < 0.05$ was considered statistically significant.

## 3. Results

**Table 1: Effect of *Aloe vera* on Blood Glucose Levels (mg/dL)**

| Group | Day 0 | Day 7 | Day 14 | Day 21 |
|---|---|---|---|---|
| I | 92.6 ± 3.4 | 93.8 ± 2.9 | 94.2 ± 3.1 | 91.7 ± 3.3 |
| II | 226.4 ± 4.2 | 241.5 ± 5.1 | 260.3 ± 5.4 | 273.7 ± 6.2 |
| III | 229.3 ± 3.7 | 180.1 ± 3.9* | 142.8 ± 4.3* | 108.5 ± 4.6* |
| IV | 228.7 ± 4.1 | 165.4 ± 4.6* | 130.6 ± 4.8* | 96.2 ± 3.9* |

*Significant compared to Group II ($p < 0.05$)




**Graph: Graphical Representation of Effect of *Aloe vera* on Blood Glucose Levels (mg/dL)**

**Table 2: Effect on Plasma Protein Levels (g/dL)**

| Group | Plasma Protein |
|---|---|
| I | 7.42 ± 0.31 |
| II | 4.18 ± 0.27 |
| III | 6.35 ± 0.29* |
| IV | 6.82 ± 0.33* |

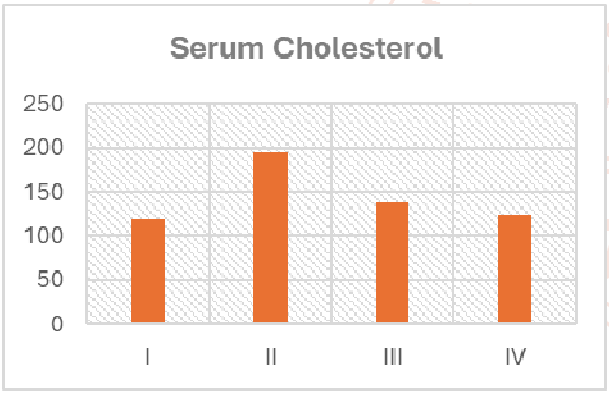
*Significant compared to Group II ($p < 0.05$)


**Graph 2: Graphical Representation of Effect of *Aloe vera* on Plasma Protein Levels (g/dL)**

**Table 3: Effect on Serum Cholesterol (mg/dL)**

| Group | Serum Cholesterol |
|---|---|
| I | 118.5 ± 3.6 |
| II | 194.7 ± 4.2 |
| III | 138.2 ± 4.5* |
| IV | 123.1 ± 4.3* |

*Significant compared to Group II ($p < 0.05$)




**Graph 3: Graphical Representation of Effect of *Aloe vera* on Serum Cholesterol Levels (mg/dL)**

## 4. Discussion

The present study demonstrates that *Aloe vera* has significant antidiabetic and hypolipidemic effects in Alloxan-induced diabetic mice. Blood glucose levels were markedly elevated in diabetic mice, consistent with beta-cell destruction by Alloxan (Szkudelski, 2001). Treatment with *Aloe vera* significantly decreased blood glucose, corroborating previous findings (Yusuf et al., 2010; Rajasekaran et al., 2006). The mechanism may involve stimulation of residual beta-cells, enhanced insulin secretion, or improvement in peripheral glucose uptake.

Plasma protein levels were significantly reduced in diabetic control mice, possibly due to increased proteolysis and reduced hepatic synthesis (Ali et al., 2020). Administration of *Aloe vera* restored plasma protein towards normal, indicating its protective effect on protein metabolism. This aligns with reports suggesting that *Aloe vera* polysaccharides exert immunomodulatory and anabolic effects (Choi & Chung, 2003).

Diabetic mice also exhibited significantly elevated serum cholesterol, indicative of altered lipid metabolism and increased cardiovascular risk (Chahil & Ginsberg, 2006). Treatment with *Aloe vera* significantly lowered serum cholesterol, in agreement with previous studies showing *Aloe vera*-induced modulation of lipid profiles (Beppu et al., 2006). The hypocholesterolemic effect may be attributed to inhibition of HMG-CoA reductase activity or increased bile acid excretion.

Compared to the standard drug glibenclamide, *Aloe vera* exhibited comparable efficacy, suggesting its potential as a natural alternative for managing diabetes and associated metabolic dysfunctions. The presence of flavonoids, saponins, and other phytoconstituents in *Aloe vera* is likely responsible for its therapeutic effects (Yagi et al., 2009; Misawa et al., 1985).

However, further studies are necessary to elucidate the molecular mechanisms and to isolate the active components responsible for the observed effects. Long-term toxicity and pharmacokinetic profiling are also essential before recommending clinical application.

## 5. Conclusion

This study concludes that *Aloe vera* exerts significant antihyperglycemic, hypocholesterolemic, and protein-sparing effects in Alloxan-induced diabetic mice. These findings provide scientific validation for the traditional use of *Aloe vera* in the treatment of diabetes mellitus. The use of *Aloe vera* as a complementary therapy could be beneficial in managing diabetes and preventing its complications.

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