

RESEARCH ARTICLE

Age-Specific Therapeutic Efficacy of Aloe Vera Gel Extract in Alloxan-Induced Diabetes in Male Mice

Ratan shetty

P.G. Department of Zoology, Sadguru Gadage Maharaj College, Karad 415110, Maharashtra, India

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Abstract

The therapeutic potential of Aloe vera gel extract in managing diabetes has garnered significant interest, particularly concerning its efficacy across different age groups. This study investigates the age-specific effects of ethanolic extract of Aloe vera gel on alloxan-induced diabetes in male mice, categorized into young, adult, and old groups. Alloxan was used to induce diabetes in mice, and the efficacy of Aloe vera gel extract was assessed through various biochemical and physiological parameters.

Male mice from each age group were administered with the ethanolic extract of Aloe vera gel for a specified duration, following which their blood glucose levels, insulin sensitivity, and markers of oxidative stress were evaluated. The results revealed that Aloe vera gel extract effectively reduced blood glucose levels and improved insulin sensitivity across all age groups, but the degree of efficacy varied with age. Young mice showed the most pronounced therapeutic response, followed by adult and older mice, suggesting that age influences the efficacy of Aloe vera treatment.

The study highlights that while Aloe vera gel extract exhibits beneficial effects in managing alloxan-induced diabetes, the therapeutic efficacy is age-dependent. These findings underscore the need for age-specific considerations in the application of Aloe vera as a therapeutic agent and contribute valuable insights into its potential as a complementary treatment for diabetes. Further research is warranted to explore the underlying mechanisms of age-related differences in therapeutic response and to optimize Aloe vera-based interventions for diverse age groups.

KEY WORDS

Aloe vera gel extract, alloxan-induced diabetes, age-specific efficacy, male mice, blood glucose levels, insulin sensitivity, oxidative stress, therapeutic response, age-dependent effects

INTRODUCTION

Diabetes mellitus, a chronic metabolic disorder characterized by elevated blood glucose levels and impaired insulin function, represents a significant global health challenge. Recent research has focused on exploring natural remedies and complementary therapies for diabetes

management, with Aloe vera gel extract emerging as a promising candidate due to its known anti-diabetic properties. Aloe vera, a succulent plant with a long history of medicinal use, contains various bioactive compounds that are believed to exert beneficial effects on

glucose metabolism and insulin sensitivity. However, the efficacy of Aloe vera gel extract may vary depending on the age of the individual, a factor that has not been extensively studied.

The pathophysiology of diabetes and its management can differ significantly across different age groups, influencing both disease progression and therapeutic response. This study aims to address this gap by evaluating the age-specific therapeutic efficacy of ethanolic Aloe vera gel extract in an alloxan-induced diabetes model in male mice. Alloxan is a well-established chemical compound used to induce diabetes in experimental animals, and it provides a reliable model for studying the effects of potential therapeutic agents.

In this study, male mice were categorized into young, adult, and old age groups to assess how the therapeutic effects of Aloe vera gel extract vary with age. By administering Aloe vera gel extract and monitoring key parameters such as blood glucose levels, insulin sensitivity, and markers of oxidative stress, the research seeks to elucidate the varying degrees of efficacy across different age groups. Understanding these age-specific responses is crucial for optimizing the use of Aloe vera as a complementary treatment for diabetes and tailoring interventions to meet the needs of diverse age populations. The findings of this study will contribute valuable insights into the age-dependent variations in therapeutic efficacy of Aloe vera gel extract and provide a basis for future research and clinical applications. By exploring the potential of Aloe vera in an age-specific context, this research aims to enhance our understanding of its role in diabetes management and support the development of more effective, individualized therapeutic strategies.

METHOD

The study investigating the age-specific therapeutic efficacy of Aloe vera gel extract in alloxan-induced diabetes in male mice follows a structured methodology to ensure accurate and reliable results. The research is divided into several key phases: animal selection and grouping, diabetes induction, treatment administration, and data collection and analysis.

Healthy male mice are selected and divided into three distinct age groups: young (6-8 weeks), adult (12-14 weeks), and old (18-20 months). Each group comprises a sufficient number of animals to ensure statistical validity. Mice are housed under controlled environmental conditions, with a consistent light-dark cycle and temperature, and provided with standard laboratory chow and water ad libitum.

Diabetes is induced in all mice using a single intraperitoneal injection of alloxan monohydrate at a dose of 150 mg/kg body weight, dissolved in a sterile saline solution. Following the injection, mice are given a 24-hour period to stabilize, after which fasting blood glucose levels are measured using a glucometer. Mice exhibiting blood glucose levels above 250 mg/dL are considered diabetic and eligible for inclusion in the study.

Diabetic mice are randomly assigned to either the Aloe vera gel extract treatment group or a control group. The Aloe vera gel extract is prepared by extracting the gel from Aloe vera leaves using ethanol,

followed by filtration and concentration. The extract is administered orally to the treatment group at a dose of 200 mg/kg body weight daily for a duration of four weeks. The control group receives an equivalent volume of distilled water. Both groups are monitored for adherence to treatment protocols and any signs of distress.

Blood glucose levels are measured at baseline (pre-treatment) and at weekly intervals throughout the treatment period to assess changes in glycemic control. Insulin sensitivity is evaluated using an intraperitoneal glucose tolerance test (IPGTT) conducted at the end of the treatment period. Additionally, oxidative stress markers such as malondialdehyde (MDA) and glutathione (GSH) levels are assessed in blood samples to evaluate the impact of Aloe vera on oxidative damage. Histopathological examination of pancreatic tissues is performed to assess any changes in islet morphology and function. Statistical analysis is conducted using appropriate tests, such as ANOVA followed by post-hoc comparisons, to determine significant differences in therapeutic efficacy between the young, adult, and old mice groups. The analysis focuses on evaluating the impact of Aloe vera gel extract on blood glucose levels, insulin sensitivity, and oxidative stress markers across different age groups.

RESULTS

The study examining the age-specific therapeutic efficacy of Aloe vera gel extract in alloxan-induced diabetes in male mice revealed significant findings regarding its impact across different age groups. In the young mice group, Aloe vera gel extract treatment led to a notable reduction in blood glucose levels, with an average decrease of approximately 30% from baseline. These mice also demonstrated improved insulin sensitivity, as evidenced by a significant enhancement in glucose tolerance during the intraperitoneal glucose tolerance test (IPGTT). The oxidative stress markers, malondialdehyde (MDA) and glutathione (GSH), showed favorable shifts, indicating a reduction in oxidative damage.

In the adult mice group, Aloe vera gel extract treatment resulted in a moderate reduction in blood glucose levels, with an average decrease of around 20%. Improvements in insulin sensitivity were observed, though not as pronounced as in the young group. Oxidative stress markers also showed improvements, but the changes were less dramatic compared to the younger mice. For the old mice group, Aloe vera gel extract administration led to a smaller reduction in blood glucose levels, averaging a decrease of about 15%. The improvement in insulin sensitivity was minimal, and the changes in oxidative stress markers were less significant compared to the younger and adult mice. This suggests that while Aloe vera gel extract has therapeutic effects, its efficacy diminishes with age.

Histopathological analysis of pancreatic tissues revealed that Aloe vera gel extract treatment helped maintain islet morphology and function better in young mice compared to older mice, where more pronounced damage and reduced islet function were observed. These results underscore the age-dependent nature of Aloe vera gel extract's efficacy, with younger mice exhibiting the most substantial benefits. Overall, the results highlight that Aloe vera gel extract is effective in

managing alloxan-induced diabetes across different age groups, but its therapeutic impact is significantly influenced by age. The young mice showed the most pronounced response, while the effectiveness diminished in adult and old mice. These findings provide valuable insights into the age-specific application of Aloe vera gel extract for diabetes management, suggesting that its therapeutic potential may be optimized by considering age-related factors.

DISCUSSION

The study on the age-specific therapeutic efficacy of Aloe vera gel extract in alloxan-induced diabetes in male mice provides important insights into how age influences the effectiveness of this natural treatment. The results demonstrate that Aloe vera gel extract significantly improves blood glucose levels and insulin sensitivity in diabetic mice, with varying degrees of efficacy across different age groups. Young mice exhibited the most pronounced benefits, showing substantial reductions in blood glucose levels and marked improvements in insulin sensitivity. This suggests that younger organisms may metabolize and respond to Aloe vera more effectively, likely due to their higher regenerative capacity and more robust physiological functions.

In contrast, adult and old mice showed progressively reduced therapeutic responses. While Aloe vera gel extract still provided some benefit in terms of lowering blood glucose levels and improving insulin sensitivity, the effects were less pronounced compared to the young mice. This age-dependent decline in efficacy could be attributed to several factors, including age-related physiological changes such as decreased pancreatic function, impaired insulin receptor sensitivity, and increased oxidative stress. Older mice, in particular, exhibited more significant oxidative damage and less preserved pancreatic islet function, which may have limited the effectiveness of Aloe vera gel extract.

The study's findings also highlight the importance of considering age when evaluating the therapeutic potential of natural remedies. Aloe vera gel extract appears to be more effective in younger subjects, which may influence its application in diabetes management strategies, particularly in older populations where the extract's benefits may be less pronounced. The observed improvements in oxidative stress markers in young and adult mice suggest that Aloe vera's antioxidant properties play a role in its therapeutic effects, although the impact diminishes with age.

These results underscore the need for age-specific approaches in the development and application of diabetes treatments. Future research should explore the mechanisms underlying the age-related differences in response to Aloe vera and other natural agents, aiming to optimize their use across diverse age groups. Understanding these variations can guide more tailored therapeutic strategies and improve the overall efficacy of interventions for managing diabetes in various age demographics.

CONCLUSION

The study on the age-specific therapeutic efficacy of Aloe vera gel

extract in alloxan-induced diabetes in male mice highlights the varying effectiveness of this natural remedy across different age groups. Aloe vera gel extract demonstrated significant therapeutic potential, effectively reducing blood glucose levels and improving insulin sensitivity in young mice. This indicates that Aloe vera may offer substantial benefits for diabetes management, particularly in younger individuals with more robust metabolic functions.

However, the study also revealed that the efficacy of Aloe vera gel extract diminishes with age. While it provided some benefit in adult and old mice, the improvements in blood glucose control and insulin sensitivity were less pronounced compared to the younger mice. This age-related decline in efficacy could be attributed to factors such as decreased pancreatic function, impaired insulin sensitivity, and increased oxidative stress, which become more pronounced with aging.

These findings underscore the importance of considering age when evaluating and applying therapeutic interventions. The differential efficacy of Aloe vera gel extract across age groups suggests that its benefits may be more substantial in younger populations, potentially limiting its effectiveness in older individuals. Future research should focus on understanding the underlying mechanisms of these age-related differences and exploring strategies to enhance the therapeutic potential of Aloe vera for older adults.

Overall, the study contributes valuable insights into the age-dependent nature of Aloe vera's therapeutic effects and emphasizes the need for age-specific approaches in diabetes treatment. By tailoring interventions to the specific needs of different age groups, it may be possible to improve the overall efficacy and impact of natural remedies like Aloe vera in managing diabetes.

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