EVALUATION OF THERAPEUTIC EFFICACY OF ALOE VERA GEL FOR EXCISIONAL WOUND HEALING MECHANISM USING ANIMAL MODEL

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Abstract: association with obesity, diabetes mellitus, and high blood pressure conditions. Various therapeutic options were available for the wound-repairing process. The current study project evaluated the healing properties of Aloe Vera gel on epidermal wounds in rats. Experimental animals (adult rats) were divided into groups A, B, and C with equal distribution. These groups represent treatment, without treatment, and control, respectively. A pair of wounds measuring 2cm x 2cm each was created hygienically on the back of each rat lateral to the spinal cord. The wounds were treated with homogenized Aloe Vera gel, while the injuries in the second group were treated with normal saline. Blood samples were collected on days 21 for hematology analysis with a standard method. Animals in group ‘A’ had significantly faster healing with shorter days of skin fall-off than the control and untreated group. Further biochemical changes in the packed cell volume, mean corpuscular volume, lymphocyte and neutrophil counts also showed significant results compared to the control group. The study concluded that Aloe Vera effectively treated epidermal wounds in adult rat models. An improvement occurred in the hematological profile of the experimental animals. These findings will go a long way in expanding the horizon of the clinical application of this plant in solving wound-healing problems in humans and other animal species.

Keywords: Aloe Vera gel, Epidermal wounds, Hematology, clinical application

Introduction: A wound is a damage to the skin or loss of continuity of epithelium, with or without loss of underlying connective tissues. Different causative agents include injury to the skin, surgery, a burn, cut, chemicals, heat, cold, friction, shear force, pressure or diseases such as leg ulcers or carcinomas (Wilkins et al., 2013). Wound healing is the mechanism of recovery of damage skin and soft tissues after injuries. It’s a complex series involved diverse signalling molecules and proteins (Lin et al., 2015). From ancient ages, natural plant extracts and herbs have been commonly applied as diseases cure options worldwide. Due to the unavailability of modern medication facilities and poor economic status, 80-85% of the human population is still attached to this traditional medicinal power of natural plants and plant extracts. Among them Aloe Vera gel and extract of honey comb (honey) discovered the wonderful power of wound healing process (Jamil et al., 2020). Various pharmaceutical herbs used as curative measures now-a-days needed further inclination for the identification of undiscovered constituents (Reina et al., 2013). Since antiquated times required for wound healing, exceptionally intricate procedures have been utilized (Chithra et al., 1998; Deng et al., 2015). On wound healing different investigations have been done, consequently various substances have been introduced that frequently here and their connections, ones which are home grown mixes (Wang et al., 2000; Adzick, 1996; Zeng et al., 2017 and Chen et al., 2015). Applications of compound formula remedies of natural extracts also limit the time required for healing. Most commonly considered prescriptions are pharmaceutical herbs (Chatterjee et al., 2013). In any case, as a compelling prescription till now, none of them can be offered. The impacts of chemical substances for example, phenition, salt serum, Vitamin A, growth factors, hydrocortisone, and Ascorbic Acid, as certain models can be referenced (Chen et al., 2012). It is picking up prominence in dentistry as it is common, and no reactions are accounted for with its utilization.

Aloe Vera plant was collected from PCSIR Society Lahore. Then gel extract was obtained by peeling fresh leaves. Potential therapeutic effects of Aloe Vera gel extract were studied in the excisional cutaneous wound healing mechanism of Sprague dawley rats.

2.3 Experimental animals and their maintenance

The male adult rats were placed in the Institute of molecular biology and Biotechnology (IMBB) departmental animal house at 26±20 °C.

2.4 Inclusion criteria

Young male rats with weights of (160 to 200) gm. were selected for the current study.

2.5 Exclusion criteria

Female rats were excluded due to breeding problem. Obese and underweight rats (150) gm were excluded to minimize variations among the animal models. Under or average rats were also excluded for the sake of consistency.

2.6 Study design

Twelve (12) Sprague dawley rats were recruited through inclusion and exclusion criteria for present study. These were properly distributed into three groups comprising four (4) rats. As showing in the following table number 2.1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Characteristics</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Control</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Experimental group (On treatment)</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>Experimental group (Without treatment)</td>
<td>4</td>
</tr>
</tbody>
</table>

The excisional cutaneous wounds were created by surgical knife in groups B and C, respectively.

2.8 Dose calculation & application of treatment
Group B rats were treated with 125mg raw extract of Aloe Vera gel water as a dose, while animals of group A and group C were not received any treatment.

2.9 Sample collection
After 24 days of treatment, rats were anesthetized by using chloroform. Later their blood samples were collected from the heart of rats by cardiac puncturing after these rats were dissected. Blood samples were shifted into two different types of properly labeled vacutainers, one with EDTA use for complete blood analysis and the second without EDTA use for serum extraction.

2.10 Biochemical analysis
2.10.1 Complete blood count
All tests were performed on the 100 Japan hematology analyzers with their stromatolyser and cell pack to assess blood count.

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Group A*</th>
<th>Group B*</th>
<th>Group C*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.875(nl/ml)</td>
<td>0.966(nl/ml)</td>
<td>0.560(nl/ml)</td>
</tr>
<tr>
<td>2</td>
<td>0.879(nl/ml)</td>
<td>0.968(nl/ml)</td>
<td>0.565(nl/ml)</td>
</tr>
<tr>
<td>3</td>
<td>0.877(nl/ml)</td>
<td>0.967(nl/ml)</td>
<td>0.566(nl/ml)</td>
</tr>
</tbody>
</table>

Footnote : (*Group A: Control, Group B: Excisional wound with treatment, Group C: Excisional wound without treatment)

Findings for hydroxyproline (HRP) levels of Groups (A, B, and C) were recorded as (0.922), (0.795), and (0.465), respectively. A significant level of hydroxyproline was observed in Group A as compared to Group B and Group C. While Group B showed a greater level than Group C but low in comparison to Group A, as represented in Figure 3.1

2.10.2 Estimation of connective tissue (Hydroxyproline (HPR))
Using standard spectrophotometric analysis, samples were estimated at 540nm for Hydroxyproline levels.

2.10.3 Estimation of catalases
Catalase enzyme catalyzed the decomposition of H₂O₂ to give H₂O and O₂. The UV absorbance of H₂O₂ can be measured at 240nm. After completion of the reaction with standard reagent, absorbance was taken at 530 nm after150ul of the mixture was added in a micro-titer plat.

Statistical Analysis Data obtained from different biochemical parameters was analyzed by student t-test and represented in the form of means where the significant difference occurred.

3. Results
The present study project was led to assess the impact of Aloe Vera extract (gel) on excisional cutaneous wounds in experimental animals. Biochemical analysis and connective tissue status were checked. Obtained results are presented in the following table.

![Fig 3.1 Graphical representation of hydroxyproline levels in different groups of experimental animals](image)

Table 3.2: Estimation of catalase (enzyme) in experimental animal models

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.9624</td>
<td>1.5368</td>
<td>1.5368</td>
</tr>
</tbody>
</table>

Evaluation of therapeutic efficacy of aloe vera gel for excisional wound healing mechanism using animal model

**Table 3.3 White blood cells (WBC) of experimental animal models**

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10.4±1.979</td>
<td>10.6±3.252</td>
<td>19.1±1.484</td>
</tr>
<tr>
<td>2.</td>
<td>11.8</td>
<td>12.4</td>
<td>20.7</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>10.4±1.979</td>
<td>10.6±3.252</td>
<td>19.1±1.484</td>
</tr>
</tbody>
</table>

Footnote :(*Group A: Control, Group B: Excisional wound with treatment, Group C: Excisional wound without treatment)

**Table 3.4 Red blood cells (RBC) of experimental animal models**

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>7.54</td>
<td>9.96</td>
<td>9.25</td>
</tr>
<tr>
<td>2.</td>
<td>7.81</td>
<td>7.83</td>
<td>6.74</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>7.67±0.190</td>
<td>8.89±1.50</td>
<td>7.99±1.77</td>
</tr>
</tbody>
</table>

Footnote :(*Group A: Control, Group B: Excisional wound with treatment, Group C: Excisional wound without treatment)

The results of Red blood cells (RBC) of Group A, B, C were recorded as (7.67), (8.89) and (7.99). Increased result significantly was observed in Group B as compared to group A and C.

**Table 3.5 Hemoglobin (HGB) of experimental animal models.**

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>14.4</td>
<td>15.7</td>
<td>13.7</td>
</tr>
<tr>
<td>2.</td>
<td>14.2</td>
<td>18.1</td>
<td>14.0</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>14.3±0.141</td>
<td>16.05±2.033</td>
<td>14.7±1.89</td>
</tr>
</tbody>
</table>

Hemoglobin (HGB) levels of Group A, B, C were recorded as (14.3), (16.05), and (14.7). The highly increased result was observed in Group B compared to Group A and C.
to Group A and C. While group B showed an increase from group C but low compared to group B.

![HGB Graph](image)

**Fig 3.5** Graphical representation of Haemoglobin (HGB) in different groups of experimental animals

**4. Discussion**

This study was planned to investigate the activity of Aloe Vera gel extracts on the different biochemical parameters involved in the wound healing process in male albino rats. The findings of the present project related to Aloe Vera gel action on wound cure indicated an improved rate of wound healing in Sprague Dawley rats by shorter days of healing compared to previous literature review reports. In this case, the old skin from the injured area was removed within 9 days compared to the control (mean 12 days), which took 12 days. **THE PRO-HEALING INGREDIENTS ARE vitamin C, amino acids, vitamin E, and zinc.** The presence of these constituents is reported in the literature in this plant.

Wound treatment in Sprague dawley rats with Aloe Vera gel significantly affected wound healing, especially during the phases of wound repairing, which are proliferative and maturation. In Aloe Vera certain components, such as flavonoids and Saponins having wonderful healing properties (Borra et al., 2011). After the final experimental period (24 days) different hematological and biochemical parameters, including Catalase enzyme, HRP, WBC, RBC, and Hemoglobin of all experimental groups were measured. The recent study observed that the hydroxyproline concentration significantly differed among all groups of rats. It was noticed that group B (treatment with aloe Vera) depicted an increased level compared to group C, while lower with the control group (Table 2.1). The results are similar to the previous research data, where more levels of HRP facilitate the wound healing mechanism (Chithra et al., 1998). Aloe Vera has been utilized as a purgative since old occasions, dermatologic conditions, and the treatment of numerous disarranges, including diseases, it is assessed by the influence of Aloe Vera gel on dermal wound healing. The significant organization of gel twice daily quickens dermal wound healing in rodents. It accelerates wound healing in animals, due to the presence of phytochemicals. Also, interacting with the growth factor receptors, which in turn stimulated a growth hormone present in the gel could have partly played important roles in faster wound healing by glucosamanns, a mannose-rich polysaccharide, and gibberellin, the activity and proliferation of fibroblasts and promoted collagen synthesis similar to earlier reports.

**5. CONCLUSION**

The current study concluded that Aloe Vera gel positively affected wound healing mechanisms. Significant clinical applications of this medicinal plant as a cure option for the solution of wound repair in both animals and human beings were reported. Hematology in the experimental treated and untreated animal groups showed significantly changed results. To further investigate with a point of view to discovering more uses of aloe Vera plant in the animal species and human apart from its wound healing effects.

**Declarations**

**Conflict of interest**

The authors have no conflict of interest.

**Data Availability statement**

All data generated or analyzed during the study are included in the manuscript.

**Ethics approval and consent to participate**

Not applicable

**Consent for publication**

Not applicable

**Funding**

Not applicable

**References**


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