

Phytochemical Analysis and Wound Healing Potential of *Aloe vera* (*Aloe massawana*) Peel Extract

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ABSTRACT

Aim/Background: *Aloe vera* peel extract holds promise for wound healing, yet its specific phytochemical composition and therapeutic potential still need to be explored, especially in San Jose, Malaybalay City, Bukidnon. This study filled the gap by investigating the phytochemical constituents of *Aloe vera* (*A. massawana*) peel extract and its implications for wound healing. **Materials and Methods:** *Aloe vera* (*A. massawana*) peel samples were gathered from local residences using purposive sampling, transformed into ethanolic extracts, and then examined phytochemically. Several studies used color-based tests to determine the presence of anthraquinones, terpenoids, alkaloids, tannins, and flavonoids. **Results:** All five (5) trials on the assays of anthraquinones, flavonoids, and tannins yielded positive results from the phytochemical screening. The colors of these compounds were red, brown-yellow, and greenish-black, respectively. However, the findings of the five (5) alkaloids and terpenoids trial tests were dark green and black, indicating a negative observation. These findings suggest possible therapeutic advantages for wound healing. **Conclusion:** The study emphasized the importance of integrating innovative scientific methods with traditional medical understanding to improve healthcare procedures. Further research is necessary to fully understand the processes that underline *Aloe vera*'s healing properties and maximize its therapeutic use in wound care.

Keywords: *Aloe vera* peel extract, *Aloe massawana*, Phytochemical analysis, Wound healing, Bioactive compounds.

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INTRODUCTION

Aloe vera, scientifically identified as *Aloe barbadensis*, stands as a prominent member of the Asphodelaceae family within the Asparagales order.^[1] Originating from Barbados, the species epithet "*barbadensis*" denotes its historical association with the island, where early settlers first recognized its therapeutic potential. Its healing properties are genuine, as indicated by the phrase "*vera*," which means truthful.^[2] The succulent plant known as *Aloe vera* exhibits perennial presence because it displays lance-shaped leaves covered in tiny, toothed edges and white specks. People commonly use the clear liquid that naturally occurs within *Aloe vera* leaves because this substance shows strong success in treating burns and nourishing the skin.^[3] *Aloe vera* grows naturally in African dry places and it prefers sunlight and well-drained land that stays above 50° Fahrenheit each night.

The genus *Aloe* encompasses over 400 species, among which *Aloe vera* reigns as the most therapeutically potent, with four species recognized for their medicinal benefits.^[4] Particularly renowned for its wound-healing properties, *Aloe vera* (*A. massawana*) has drawn notice for its potential to treat a variety of skin conditions.^[5] However, despite its widespread use, a significant research gap exists concerning *Aloe vera*'s phytochemical composition and medicinal efficacy, notably in San Jose, Malaybalay, Bukidnon. Comprehensive investigations clarifying the particular bioactive chemicals found in locally grown *Aloe vera* and their functions in wound healing are noticeably lacking, despite the plant's long-standing cultural and traditional use in the area. This research gap prevents the application of efficient natural wound-healing treatments and prevents the creation of healthcare based on research practices that are adapted to the demands of the community. Addressing this gap is paramount to enhancing understanding of *Aloe vera*'s therapeutic benefits and improving public health outcomes in San Jose, Malaybalay, and Bukidnon.

Applying *Aloe vera* topically has demonstrated potential in hastening wound healing when used in conjunction with adjunct therapies like shockwave or ultrasound therapy.^[6,7]



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Moreover, understanding the therapeutic benefits of *Aloe vera* in this locale holds implications for the broader field of natural wound healing treatments, potentially enhancing healthcare outcomes and well-being in similar geographic regions. Research interest in *Aloe vera* phytochemicals and skin wound healing continues to grow because this plant contains multiple bioactive components, including vitamins and enzymes, among other substances.^[8] Wound healing research indicates that *Aloe vera* components advance tissue regeneration processes because these properties position the plant as a promising therapeutic choice for treatment^[9,10] Additionally, *Aloe vera* demonstrates pharmacological traits by preventing viruses along with bacteria and reducing inflammation while acting as an antioxidant, thereby confirming its safety and success as a treatment for skin wounds.^[11]

Additionally, the research aims to understand the phytochemical properties of *Aloe vera* gel through comprehensive testing while seeking to identify possible bioactive components that enhance medicinal characteristics. The anticipated findings hold significant implications for researchers and the medical community, offering insights into *Aloe vera*'s therapeutic potential and paving the way for exploring innovative medicinal sources. To address a significant knowledge gap, the research investigates how *Aloe vera* can contribute to wound healing, particularly in the San Jose Malaybalay Bukidnon area. Through improving knowledge of the phytochemical makeup and therapeutic qualities of *Aloe vera*, this study aims to support the creation of evidence-based healthcare treatments suited to the community's requirements, ultimately fostering better public health and well-being.

MATERIALS AND METHODS

Research Design

The phytochemical composition and potential for wound healing of *Aloe vera* in the San Jose, Malaybalay, Bukidnon region were investigated in this study using a qualitative approach. The content of alkaloids, tannins, terpenoids, flavonoids, and anthraquinones was examined in the sample *Aloe vera* peel extract. Through careful observations and analysis, this method enables the exploration of minute factors that may impact *Aloe vera*'s therapeutic efficacy in wound management within the research area.

Locale of the Study

This research was conducted in San Jose, Malaybalay, Bukidnon, as the primary study location. Situated in the heart of Bukidnon province in the Philippines, San Jose offers a diverse and rich environment conducive to the growth of *Aloe vera* plants. The favorable climate and soil conditions in this area make it an ideal setting for studying the phytochemical properties of *Aloe vera* and its potential applications in skin wound healing.

Additionally, the community in San Jose provided valuable insights and perspectives that enhanced the depth and relevance of our research findings.

Identification of *Aloe vera* Species

According to "Identification of *Aloe vera* by",^[12] the samples were pre-identified before being sent to the Forest and Wetland Research, Development, and Extension Center for a comprehensive analysis and final identification.

Sample Collection and Preparation

Purposive sampling was employed in San Jose, Malaybalay, Bukidnon, focusing on households with *Aloe vera* plants or individuals familiar with its use for wound healing. Criteria aligned with research objectives were defined, and permission was obtained before collecting samples, ensuring informed consent. Samples were carefully collected from healthy leaves, minimizing plant disturbance and contamination risks. This meticulous process aimed to maintain sample integrity and uphold the reliability of the study's findings.

Following collection, *Aloe vera* skin peels were carefully dried in an oven and then macerated with ethanol for three days at San Isidro College's laboratory. The resulting ethanolic extract underwent filtration and subsequent phytochemical testing. This testing, adhering to standardized procedures, focused on detecting alkaloids, tannins, terpenoids, flavonoids, and anthraquinones using various chemical reagents. This meticulous process aimed to identify specific phytochemical compounds in the *Aloe vera* peel extract, ensuring the accuracy and reliability of the results.

Data Gathering Procedure

Phytochemical Analysis

Preparation and Implementation of Phytochemical Screening: In accordance with procedures from,^[13-15] secondary metabolites in *Aloe vera* (*A. massawana*) peels were examined using ethanolic extracts.

Alkaloids Wagner test: 2 drops of Wagner reagent were added to the mixture of 1.5 mL ethanolic extract and 1.5 mL HCl before agitation for 5 min. The presence of alkaloids caused both precipitate formation and the reddish-brown color change.

Anthraquinones Hydrochloric Acid Test: A mixture of 1.5 mL ethanolic extract received 2 drops of Hydrochloric Acid (HCl) before agitation for 5 min. The appearance of red color indicated the presence of anthraquinones in the solution.

Flavonoids Ammonia Solution Test: 5 mL of diluted ammonia solution were mixed with five milliliters of extract, and then conc H_2SO_4 was added. Flavonoids are indicated by the appearance of a yellow.

Tannins Ferric chloride Test: 1.5 mL of ethanolic extract was mixed with two (2) ferric chloride solutions. Tannins were present when the extract's hue changed to greenish-blue or greenish-black.

Terpenoids Salkowski test: After adding 2 mL of chloroform to 1.5 mL of ethanolic extract and shaking the mixture for 5 min, 1 mL of sulfuric acid was added. Each sample's alterations were noted after they were shaken. Terpenoids were present when the color turned reddish-brown.

Ethical Consideration

To uphold ethical standards and protect participants' rights, the research on *Aloe vera*'s healing potential for skin wounds will include obtaining consent, respecting privacy, minimizing harm, adhering to regulations, and engaging with the community to consider local perspectives.

RESULTS

Phytochemicals Present in *Aloe vera* (*Aloe massawana*)

The results of phytochemical tests conducted over multiple experiments are systematically recorded in Table 1. Each experiment was analyzed for a range of compounds, including tannins, alkaloids, anthraquinones, flavonoids, and terpenoids, using specific testing techniques like the Salkowski, Wagner, hydrochloric acid, ammonia solution, and ferric chloride tests, in that order. Results are detailed through color indicators, with dark green indicating negative results for alkaloids and black for terpenoids. At the same time, red signifies positive results for anthraquinones, brown-yellow for flavonoids, and greenish-black for tannins.

Table 1 shows that anthraquinones, flavonoids, and tannins are the positive results while alkaloids and terpenoids are the negative results. The researchers use the hydrochloric acid that these compounds contain, given that anthraquinones have a red color, to achieve the intended results. Flavonoids gave the color to its brownish-yellow hue, which is required for the intended outcome. Researchers examined flavonoids in an ammonia solution to get the expected outcomes. Tannins are colored greenish-black, and this color is necessary for an effective result. The ferric chloride test for tannins was used to achieve the required results. The information suggests the *Aloe vera* peel extract has chemicals like tannins, flavonoids, and anthraquinones that are good for healing wounds. The lack of terpenoids and alkaloids may suggest that other ingredients have a greater influence on the extract's capacity to heal wounds.

Wound Healing Potential of *Aloe vera* (*Aloe massawana*) Based on the Phytochemicals Present

While some literature suggests alkaloids and terpenoids play a significant role in *Aloe vera*'s wound-healing properties, this

finding contradicts that assertion. However, the presence of anthraquinones, flavonoids, and tannins aligns with previous research indicating their potential contribution to wound healing. Anthraquinones possess antimicrobial and anti-inflammatory properties, flavonoids support tissue repair, and tannins promote wound contraction and reduce bleeding, collectively enhancing the wound-healing properties of *Aloe vera* peel extract.

DISCUSSION

Phytochemicals Present in *Aloe vera* (*Aloe massawana*)

The research findings^[16,17] stated that anthraquinones like aloin, aloe-emodin, and rhein were found to promote wound healing by stimulating fibroblast and connective tissue formation, promoting epidermal growth and repair, and counteracting corticosteroid-induced wound-healing suppression. Additionally, tannins, present in *Aloe vera*, contribute to wound healing by forming a protective layer over the skin, reducing inflammation, and promoting tissue regeneration, as highlighted by^[10,18,19] Furthermore, flavonoids in *Aloe vera* exhibit antioxidative, anti-inflammatory, and anti-mutagenic properties, essential for wound healing.^[20-22] Together, these phytochemical constituents synergistically contribute to *Aloe vera*'s wound-healing properties, offering promise as a natural remedy for various skin ailments.

The phytochemical examination of *A. massawana* ethanol extract, as conducted by,^[23] aligns with the findings presented in this paper. Reynolds identified several significant chemicals, including alkaloids, anthraquinones, flavonoids, tannins, and steroids, through various tests such as Mayer's test, Dragendorff's test, and the ferric chloride test. These tests verified the identity of phytochemical properties. Additionally, Reynolds emphasized the variety of biological activity linked to these substances, including the antibacterial and anti-inflammatory properties of anthraquinones and the anti-inflammatory, antioxidant, and anti-cancer properties of flavonoids. The study's findings contradict,^[24] as alkaloids were absent despite their presence in their study. Similarly,^[25] reported terpenoids in *Aloe vera* extract, which the researchers did not find, suggesting variations in composition due to factors like plant species or extraction methods. While alkaloids and terpenoids are typically associated with wound healing, the study's identification of anthraquinones, flavonoids, and tannins aligns with their known roles.

Wound Healing Potential of *Aloe Vera* (*Aloe massawana*) Based on the Phytochemicals Present

Previous studies^[16,17,26] emphasize the significant roles of anthraquinones, flavonoids, and tannins in *Aloe vera*'s wound-healing properties. Anthraquinones like aloin, aloe-emodin, and rhein stimulate fibroblast and connective tissue formation, promote epidermal growth, and possess antimicrobial and anti-inflammatory properties. Similarly, tannins contribute

Table 1: Phytochemical Tests on *A. massawana* Ethanolic Extract.

Phytochemical and Test Used	Trials	Results	Remarks
Alkaloids using Wagner Test	1	Dark green	Negative
	2	Dark green	Negative
	3	Dark green	Negative
	4	Dark green	Negative
	5	Dark green	Negative
Anthraquinones using Hydrochloric acid Test	1	Red	Positive
	2	Red	Positive
	3	Red	Positive
	4	Red	Positive
	5	Red	Positive
Flavonoids using Ammonia solution Test	1	Brown-yellow	Positive
	2	Brown-yellow	Positive
	3	Brown-yellow	Positive
	4	Brown-yellow	Positive
	5	Brown-yellow	Positive
Tannins using Ferric chloride Test	1	Greenish-black	Positive
	2	Greenish-black	Positive
	3	Greenish-black	Positive
	4	Greenish-black	Positive
	5	Greenish-black	Positive
Terpenoids using Salkowski Test	1	Black	Negative
	2	Black	Negative
	3	Black	Negative
	4	Black	Negative
	5	Black	Negative

by forming a protective layer, reducing inflammation, and promoting tissue regeneration, as highlighted.^[10,18,19] Flavonoids exhibit antioxidative, anti-inflammatory, and anti-mutagenic properties essential for wound healing, as indicated by studies by.^[21,22]

Discrepancies in findings may arise from variations in *Aloe vera* species, growing conditions, or processing methods, as noted.^[27,28] Despite the absence of alkaloids and terpenoids, the presence of anthraquinones, flavonoids, and tannins supports *Aloe vera*'s efficacy in wound healing, consistent with existing literature. Further research is needed to uncover the specific mechanisms underlying these phytochemicals' contributions to wound healing and to optimize their clinical application.

CONCLUSION

The analysis of *Aloe vera* (*Aloe massawana*) peel extract, conducted in alignment with our statement of the problem regarding the presence of phytochemicals, revealed the presence of tannins, flavonoids, and anthraquinones. This substantiates a previous

understanding of *Aloe vera*'s chemical composition and potential benefits in promoting wound healing. The absence of alkaloids and terpenoids in our findings deviates from the anticipated phytochemical profile, warranting further exploration to comprehend the intricacies of *Aloe vera*'s chemical composition and its implications for wound healing mechanisms.

The literature review highlights the significant roles of flavonoids, anthraquinones, and tannins found in *Aloe vera* in promoting wound healing. As stated in previous studies, these compounds contribute significantly to wound healing processes through their diverse pharmacological properties. Flavonoids exhibit antioxidant and anti-inflammatory effects, while anthraquinones possess antimicrobial and anti-inflammatory properties, all conducive to tissue regeneration and repair. Moreover, tannins are significant in wound healing because they promote tissue regeneration and provide astringent effects. Despite the findings indicating the absence of alkaloids and terpenoids, which contrast with some literature, the collective evidence underscores the therapeutic potential of *Aloe vera* in wound healing applications,

highlighting avenues for further research to optimize its clinical efficacy.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SUMMARY

The phytochemical composition and potential for wound healing of *Aloe massawana* peel extract in San Jose, Malaybalay, Bukidnon, are examined in this study. Based on the literature, it seeks to identify the existence of anthraquinones, flavonoids, terpenoids, tannins, and alkaloids and evaluate their capacity to heal wounds. The Forest and Wetland Research Center was the site of an ocular inspection, purposive sampling utilizing CBPR techniques, and identity verification. According to the phytochemical investigation at San Isidro College, tannins, flavonoids, and anthraquinones were found, but alkaloids and terpenoids were not, suggesting that these compounds may have therapeutic uses in wound healing.

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