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Wound Healing Activity Of Himavan Agad - A Review Article

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ABSTRACT:

Background: *Wound healing is a multifactorial biological process influenced by infection, inflammation, oxidative stress, and tissue regeneration. Classical Ayurvedic texts describe numerous formulations under vrana chikitsa for cleansing (shodhana) and healing (ropana) of wounds. Himavan Agad, a polyherbal formulation mentioned in Aṣhṭanga Hṛidaya and Aṣhtanga Sangraha, is primarily indicated in toxic and inflammatory dermatoses but exhibits properties relevant for wound care.*

Objective: *To critically review classical references, phytochemical composition, and pharmacological evidence of Himavan Agad in relation to wound healing.*

Methods: *Literature was reviewed using PubMed, ScienceDirect, AYUSH Research Portal, and Google Scholar. Classical Ayurvedic texts, postgraduate theses, and pharmacognostical monographs were also screened. Data on phytochemistry, pharmacological actions, and wound-healing potential of individual ingredients were synthesized.*

Results: *Himavan Agad contains 17 ingredients including Ficus species (Nyagrodha, Udumbara, Ashvattha, Plaksha), Triphala (Haritaki, Bibhitaka, Amalaki), Yaṣhṭimadhu, Nagapuṣhpa, Chandana, Padmaka, Utpala, Elavaluka, Jivaka, Ṛuṣabhaka, and Madhu. Preclinical studies report anti-inflammatory, antioxidant, antimicrobial, and angiogenic activities. Animal models demonstrate accelerated wound contraction, enhanced granulation tissue, and improved epithelialization. Compared to modern topical agents, Himavan Agad shows broader multi-target effects with minimal adverse risks.* ***Conclusion:*** *Himavan Agad embodies Ayurvedic principles of shodhana and ropana, acting through antimicrobial, anti-inflammatory, and tissue-regenerative mechanisms. Clinical validation, standardization, and development of novel dosage forms are essential to integrate this formulation into modern wound care.*

Keywords: *Himavan Agad, wound healing, Ayurveda, Vrana chikitsa, phytochemistry, polyherbal formulation.*

INTRODUCTION

Wound healing (*vraṇa ropana*) is a complex, dynamic biological process involving cellular and biochemical events that restore tissue integrity after injury. [1] *Sushruta*, regarded as the "Father of Surgery," emphasized wound care and described sixty modalities (*Shaṣṭi upakrama*) for *vrana shodhana* (cleansing) and *vrana ropana* (healing). [2] These procedures highlight both infection control and aesthetic restoration, reflecting principles that remain clinically relevant. Biomedically, wound healing progresses through four overlapping stages: hemostasis, inflammation, proliferation, and remodeling. [3,4] Several systemic (e.g., diabetes, malnutrition, immunosuppression) and local (e.g., ischemia, microbial infection, oxidative stress) factors delay healing. [5,6] Globally, chronic wounds affect 1–2% of the population, leading to significant morbidity and economic burden. [7,8]

Modern topical agents, while widely used, present limitations. Silver sulfadiazine, a standard burn therapy, delays keratinocyte migration; [9] mafenide acetate is linked to metabolic acidosis; [10] and mupirocin resistance is increasingly reported. [11] Corticosteroid-based creams suppress inflammation but cause

dermal atrophy and impaired collagen deposition with long-term use. [12] Furthermore, the World Health Organization warns of a growing antimicrobial resistance crisis, limiting antibiotic efficacy in wound care. [13] in contrast, Ayurveda offers holistic, multi-target approaches. Polyherbal formulations combine agents with antimicrobial, anti-inflammatory, antioxidant, and rejuvenative properties. One such formulation is *Himavan Agad*, described in *Aṣṭhanga Hṛidaya* (*Uttarasthana 36th chapter*) and *Aṣhṭanga Samgraha* (*Adhyaya 42*), traditionally indicated for *Mandali sarpaviṣha* (viper bite). [14,15] Its therapeutic range extends to *Viṣarpa* (erysipelas), *viṣphoṭa* (blisters), *shotha* (inflammation), and *jvara* (fever). These classical indications conceptually overlap with modern inflammatory dermatoses and wound pathologies. Phytochemical analyses reveal that its 17 ingredients—including *Ficus* species (*Nyagrodha, Udumbara, Ashvattha, Plakṣa*), *Triphala* (*Haritaki, Bibhitaka, Amalaki*), *Yaṣhṭimadhu* (*Glycyrrhiza glabra*), *Nagapuṣpa* (*Messua ferrea*), *Chandana* (*Santalum album*), *Padmaka* (*Prunus puddum*), *Utpala* (*Nymphea alba*), *Elavaluka* (*Prunus cerasus*), *Jivaka* (*Microstylis musifera), Rushabhaka (Microstylis wallichii)* and *Madhu* (honey)—possess tannins, flavonoids, phenolics, and glycosides with antimicrobial, antioxidant, and wound-healing properties. [16–21] Preclinical studies demonstrate wound contraction, enhanced granulation, angiogenesis, and collagen cross-linking. [22–25] Clinical evidence on honey and *Triphala* formulations further supports their role in faster epithelialization and scar modulation. [26-28] Thus, *Himavan Agad* exemplifies the Ayurvedic concept of *yoga vahi*, synergistic potentiation, making it a promising candidate for integrative wound management. This review consolidates classical descriptions, phytochemistry, pharmacological studies, and modern clinical data to critically appraise its wound-healing potential.

MATERIALS AND METHODS

Literature Search Strategy

A narrative review methodology was employed. [29] Electronic databases (PubMed, ScienceDirect, AYUSH Research Portal, and Google Scholar) were searched for publications between January 2000 and July 2025 using keywords: *"Himavan Agad," "Ayurveda wound healing," "Ayurvedic vrana chikitsa," "polyherbal wound formulation,"* and botanical names of each constituent. Manual research included postgraduate theses, classical Ayurvedic compendia, and pharmacognostical monographs. [30]

Inclusion Criteria

- Classical references mentioning *Himavan Agad*.
- Experimental (in vitro, in vivo) studies on antimicrobial, anti-inflammatory, antioxidant, or wound-healing activities of ingredients.
- Pharmacognostical studies and phytochemical monographs.

Exclusion Criteria

- Non-peer-reviewed, anecdotal, or irrelevant studies.
- Reports not related to wound healing or phytochemistry.

Data Extraction and Synthesis

- Ayurvedic attributes (*rasa, virya, vipaka, karma*).
- Major Phytoconstituents of each ingredient.
- Pharmacological activities relevant to wound healing.

Findings were mapped to wound-healing phases (*hemostasis, inflammation, proliferation, remodeling*). [31]

Table 1: Properties of ingredients of *Himavan Agad*

Sr. No	Drug (Ayurvedic)	Botanical Name	***Rasa***	***Virya***	***Vipaka***	***Karma*** (Action)
1.	*Nyagrodha* [32]	*Ficus bengalensis*	*Kashaya*	*Shita*	*Katu*	*Stambhana, Vraṇaropana*
2.	*Udumbara* [33]	*Ficus glomerata*	*Madhura, Kaṣhaya*	*Shita*	*Katu*	*Vrana shodhana, Ropana*
3.	*Ashvatha* [34]	*Ficus religiosa*	*Kaṣhaya*	*Shita*	*Katu*	*Raktaprasadaka, Varnya*
4.	*Plakṣha* [35]	*Ficus lacor*	*Kaṣhaya*	*Shita*	*Katu*	*Shothaghna, Varnya*
5.	*Vetas* [36]	*Salix caprea*	*Tikta, Kashaya, Madhura*	*Shita*	*Katu*	*Shothaghna, Dahaprashamana*

6.	*Haritaki* [37]	*Terminalia chebula*	*Pancharasa (except lavaṇa)*	*Ushna*	*Madhura*	*Rasayana, Vraṇaropana*
7.	*Bibhitaka* [38]	*Terminalia bellerica*	*Kashaya*	*Ushna*	*Madhura*	*Shothaghna, Vedanasthapaka*
8.	*Amalaki* [39]	*Emblica officinalis*	*Amla, Madhura, Kashaya*	*Shita*	*Madhura*	*Rasayana, Hṛdya*
9.	*Yaṣhṭimadhu* [40]	*Glycyrrhiza glabra*	*Madhura*	*Shita*	*Madhura*	*Ropana, Viṣhaghna*
10.	*Nagapuṣpa* [41]	*Mesua ferrea*	*Kashaya*	*Ushna*	*Katu*	*Jvaraghna, Viṣhaghna*
11.	*Elavaluka* [42]	*Prunus cerasus*	*Kashaya*	*Shita*	*Katu*	*Krimighna, Rasayana*
12.	*Jivaka* [43]	*Microstylis musifera*	*Kaṣhaya, Tikta*	*Shita*	*Madhura*	*Jivaniya, Rasayana*
13.	*Rushabhaka* [44]	*Microstylis wallichii*	*Kaṣhaya, Tikta*	*Shita*	*Madhura*	*Rasayana, Vraṇaropana*
14.	*Chandana* [45]	*Santalum album*	*Tikta*	*Shita*	*Katu*	*Raktaprasadaka, Varnya*
15.	*Padmaka* [46]	*Prunus puddum*	*Kaṣhaya, Tikta*	*Shita*	*Katu*	*Rucikara, Garbhasthapaka*
16.	*Utpala* [47]	*Nymphea alba*	*Madhura, Kaṣhaya, Tikta*	*Shita*	*Madhura*	*Tridoṣhahara, Jvaraghna*
17.	*Madhu [48]*	Honey	*Madhura, Kashaya*	*Ushna*	*Madhura*	*Shodhana, Ropana, Yogavahi*

Table 2: Phytochemicals and pharmacological properties of ingredients *of Himavan Agad*

Sr No.	Plant	Major Phytochemicals	Reported Pharmacological Activities
1	*Ficus bengalensis [49]*	Flavonoids, tannins, lupeol, β-sitosterol	Anti-inflammatory, antioxidant, immunomodulatory
2	*Ficus glomerata [50]*	Tannins, lupeol, stigmasterol	Wound healing, antibacterial, hepatoprotective
3	*Ficus religiosa [51]*	Tannins, saponins, steroids	Anti-inflammatory, antimicrobial, wound healing
4	*Ficus lacor [52]*	Lupeol, flavonoids, coumarins	Antioxidant, anti-arthritic
5	*Salix caprea [53]*	Salicin, tannins, salicylaldehyde	Analgesic, anti-inflammatory, antioxidant
6	*Terminalia chebula [54]*	Tannins, gallic acid, chebulagic acid	Angiogenic, antimicrobial, wound contraction
7	*Terminalia bellerica [55]*	Gallic acid, ellagic acid, lignans	Antioxidant, antimicrobial, angiogenic
8	*Emblica officinalis [56]*	Emblicanin A & B, ellagic acid, quercetin	Antioxidant, immunomodulatory
9	*Glycyrrhiza glabra [57]*	Glycyrrhizin, glabridin, flavonoids	Anti-inflammatory, epithelialization
10	*Mesua ferrea [58]*	Xanthones, mesuaferrone, flavonoids	Wound healing, antioxidant, analgesic

11	*Prunus cerasus [59]*	Flavonoids (apigenin, chrysin), prunasin	Antimicrobial, nervine tonic
12	*Microstylis musifera [60]*	Alkaloids, flavonoids	Anti-inflammatory, analgesic
13	*Microstylis wallichii [61]*	Isoflavones, puerarin	Antioxidant, wound healing
14	*Santalum album [62]*	β-santalol, cyanidin-3-glucoside	Antioxidant, collagen promoter
15	*Prunus puddum [63]*	Flavonoids (puddumin A & B)	Antioxidant, antibacterial
16	*Nymphea alba [64]*	Polyphenols, glycosides, alkaloids	Antioxidant, anti-inflammatory
17	*Honey [65]*	Enzymes, flavonoids, ascorbic acid	Antimicrobial, collagen deposition, granulation

LITERATURE REVIEW

Classical Context

Ayurveda emphasizes *vrana chikitsa* (wound care) through dual strategies of *shodhana* (cleansing) and *ropana* (healing). *Sushruta* described sixty modalities (*ṣhaṣṭi upakrama*) for wound management, including herbal pastes, irrigation, suturing, and bandaging. [1,2] These interventions, rooted in holistic principles, are aimed at infection control, tissue repair, and scar prevention.

Himavan Agad is described in *Aṣhṭanga Hṛidaya* (*Uttarasthana 36*) and *Aṣhṭanga Sangraha* (*Adhyaya 42*) as a polyherbal antidote for *mandali sarpaviṣha* (viper bite). [14,15] Beyond toxicology, it is indicated in *viṣarpa* (erysipelas), *viṣphoṭa* (blisters), *shotha* (inflammation), and *daha* (burning). These clinical contexts closely parallel wound-related inflammation and infective dermatoses.

Its formulation of 17 ingredients—including *Ficus* spp., *Triphala*, *Vetas* (*Salix caprea*), *Yaṣhṭimadhu*, *Nagapuṣhpa*, *Chandana*, *Padmaka*, *Utpala*, rare *Ashtavarga* herbs, and *Madhu* (honey)—represents a balanced design, addressing multiple pathogenic pathways while ensuring *rasayana* (rejuvenative) support. [32–48]

Ingredient-wise Modern Evidence

Ficus Group (Nyagrodha, Udumbara, Ashvattha, Plakṣha)

- ***Ficus bengalensis (Nyagrodha):*** Contains lupeol, β-sitosterol, and tannins; exhibits anti-inflammatory and antioxidant properties; enhances wound contraction in excision models. [32,49]
- ***Ficus glomerata (Udumbara):*** Shows antimicrobial activity and accelerates granulation tissue formation. [33,50]
- ***Ficus religiosa (Ashvattha):*** Improves tensile strength of wounds; leaf extracts suppress cytokine-mediated inflammation. [34,51]
- ***Ficus lacor (Plakṣha):*** Rich in flavonoids and coumarins; demonstrates anti-inflammatory and hepatoprotective effects. [35,52]

Summary: Collectively, *Ficus* species contribute *shothaghna* (anti-inflammatory), *stambhana* (styptic), and *vraṇaropaka* (healing) properties.

***Vetas* (*Salix caprea*):** Contains salicin; reduces inflammation, pain, and oxidative stress. [20, 36, 53]

***Triphala* Group (*Haritaki, Bibhitaka, Amalaki*)**

- ***Terminalia chebula (Haritaki):*** Tannin-rich extracts stimulate angiogenesis and fibroblast proliferation, enhancing wound contraction. [37,54]
- ***Terminalia bellerica (Bibhitaka):*** Possesses antimicrobial and antioxidant activities, supporting wound closure. [38,55]
- ***Emblica officinalis (Amalaki):*** Provides emblicanins and quercetin; reduces ROS in wounds and improves collagen synthesis. [39,56]

Summary: *Triphala* enhances multiple phases of healing and functions as a *rasayana*, strengthening systemic defense. [29–31]

Supportive Herbs

- ***Glycyrrhiza glabra (Yaṣhṭimadhu):*** Glycyrrhizin regulates TNF-α and promotes epithelialization; clinical trials support dermatological use. [40,57]
- ***Mesua ferrea (Nagapuṣhpa):*** Mesuaferrone and xanthones accelerate fibroblast proliferation and wound contraction. [41,58]

- ***Santalum album (Chandana):*** β-santalol reduces lipid peroxidation and enhances angiogenesis. [45,62]
- ***Prunus puddum (Padmaka):*** Flavonoids puddumin A & B demonstrate antioxidant and antibacterial activity. [46,63]
- ***Nymphea alba (Utpala):*** Polyphenols provide anti-inflammatory and antioxidant protection. [47,64]
- ***Prunus cerasus (Elavaluka):*** Contains apigenin and chrysin with antimicrobial and nervine tonic roles. [42,59]

Summary: These herbs provide adjunct antimicrobial, antioxidant, and collagen-stimulating effects.

Rare *Astavarga* Herbs (*Jivaka, Ṛuṣhabhaka*)

- ***Microstylis musifera (Jivaka):*** Exhibits analgesic and anti-inflammatory effects. [43,60]
- ***Microstylis wallichii (Ṛuṣhabhaka):*** Contains isoflavones like puerarin with antioxidant and wound-healing potential. [44,61]
- **Substitution:** ***Pueraria tuberosa (Vidari)*** is often used due to scarcity, with evidence of angiogenic and collagen-enhancing actions. [54]

Summary: These herbs, categorized as *jivaniya rasayana*, rejuvenate tissues and systemically support wound recovery.

Honey (*Madhu*)

***Sushruta* emphasizes honey's wound-healing role:**

"Madhu śītaṃ rūkṣam lekhanam sandhānaṃ ropanam ca vraṇeṣu prayojyam" (Suśruta Saṃhitā, Sūtrasthāna 45/133). [2]

→ **Translation:** Honey is cooling, scraping, binding, and promotes cleansing and healing of wounds.

Modern evidence:

- Broad-spectrum antibacterial action against resistant pathogens. [28,29]
- Inhibits biofilm formation, reduces exudate, and enhances granulation. [30,31]
- Stimulates fibroblast activity and collagen deposition. [26,27]
- Clinical trials confirm faster epithelialization and reduced infection rates in burns and ulcers. [26,32]

Summary: Honey acts as both *shodhana* (cleansing) and *ropana* (healing), bridging Ayurvedic theory with biomedical validation.

Integrative Insights

The synergy of *Himavan Agad*'s ingredients spans all phases of wound repair:

- **Hemostasis:** Tannins in *Haritaki* and *Bibhitaka* stabilize clotting. [37,38,54,55]
- **Inflammation:** Flavonoids in *Ficus* spp. and salicin in *Vetas* suppress prostaglandins. [20,32–36,53]
- **Antioxidant defense:** Emblicanins (*Amalaki*), β-santalol (*Chandana*), flavonoids (*Padmaka*, *Utpala*) reduce oxidative stress. [39,45,46]
- **Angiogenesis & proliferation:** Glycyrrhizin (*Yaṣhṭimadhu*), xanthones (*Mesua ferrea*), honey enzymes stimulate fibroblast growth and neovascularization. [40,41,58,65]
- **Remodeling:** *Triphala* polyphenols and honey ensure collagen cross-linking and scar modulation. [29,54,65]

Thus, *Himavan Agad* embodies the Ayurvedic principle of *yogavahi*, where multiple herbs act synergistically to achieve broader efficacy than individual drugs.

DISCUSSION

Wound healing remains a clinical challenge despite biomedical advances in surgical techniques, antimicrobials, and wound dressings. [5–7] Chronic ulcers, diabetic wounds, and burns contribute significantly to morbidity, with global prevalence estimated at 1–2% of the population. [7,8] Modern topical agents such as silver sulfadiazine and mafenide acetate, though widely used, are associated with adverse effects including delayed epithelialization, dermal cytotoxicity, and metabolic acidosis. [9,10] Corticosteroid creams reduce inflammation but impair collagen deposition and cause dermal atrophy. [12] Furthermore, the rise of antimicrobial resistance limits the effectiveness of antibiotic-based wound care. [11,13]

Ayurveda offers multi-target strategies through polyherbal formulations. *Himavan Agad*—classically indicated in *mandali sarpaviṣha* (viper bite poisoning)—also addresses *viṣarpa* (erysipelas), *viṣphoṭa* (blisters),

shotha (inflammation), and *daha* (burning). [14–15] These pathologies overlap conceptually with infected, inflamed, or non-healing wounds. Its 17 ingredients act synergistically to provide antimicrobial, anti-inflammatory, antioxidant, angiogenic, and collagen-promoting effects. [29–65]

Table 03. Comparison: *Himavan Agad* vs Modern Topical Agents

Parameter	*Himavan Agad*	Modern Topical Agents
Antimicrobial [24,27,35]	Honey, *Triphala*, *Yaṣhtimadhu* effective against bacteria & fungus.	Mupirocin, bacitracin; prone to resistance
Anti-inflammatory [19–23,36]	Ficus spp., *Vetas* reduce prostaglandins & cytokines	Corticosteroids; risk of dermal atrophy
Antioxidant [26,32,33,39,45]	*Amalaki, Chandana, Padmaka* reduce oxidative stress	Most agents lack antioxidant capacity
Collagen/Granulation [24,27,37,40,57]	*Yashtimadhu, Haritaki,* Honey stimulates fibroblasts & angiogenesis	Silver sulfadiazine delays epithelialization
Systemic Safety [7–13]	Rasayana action, low toxicity	Cytotoxicity, metabolic acidosis, resistance

Summary: *Himavan Agad* provides broader coverage across wound-healing pathways, while modern agents usually target one mechanism with potential adverse effects.

Probable mode of action

The actions of *Himavan Agad* can be mapped to the biomedical phases of wound healing:

1. Hemostasis

- *Haritaki* and *Bibhitaka* tannins exert astringent effects, stabilizing clot formation (*stambhana*). [37,38,54,55]
- *Ficus bengalensis* and *Udumbara* flavonoids enhance vasoconstriction. [32,33,49,50]

2. Inflammation Control

- Lupeol and flavonoids from *Ficus religiosa* and *F. bengalensis* inhibit COX pathways. [19,21,34,51]
- *Vetas* salicin acts like aspirin, reducing prostaglandins. [36,53]
- *Yaṣhṭimadhu* glycyrrhizin down regulates TNF-α and IL-1. [40,57]

3. Antioxidant Defense

- *Amalaki* emblicanins scavenge ROS. [39,56]
- *Chandana* β-santalol protects from lipid peroxidation. [45,62]
- *Padmaka* and *Utpala* flavonoids support oxidative balance. [46,47,63,64]

4. Angiogenesis & Proliferation

- *Yaṣhṭimadhu* stimulates fibroblast growth. [40,57]
- *Mesua ferrea* xanthones enhance angiogenesis. [41,58]
- Honey enzymes (glucose oxidase, catalase) promote neovascularization. [24–28,65]
- *Haritaki* tannins enhance collagen cross-linking. [37,54]

5. Remodeling & Scar Modulation

- *Triphala* polyphenols improve tensile strength and collagen alignment. [29–31]
- Honey accelerates epithelialization and reduces scar hypertrophy. [24–28]
- *Ashtavarga* herbs (*Jivaka, Ṛuṣhabhaka*) act as *rasayana*, improving systemic vitality for tissue remodeling. [43,44,60,61]

Summary: The synergy of phytochemicals aligns with *Ayurvedic shodhana–ropana* principles and modern wound-healing pathways, providing a mechanistic basis for clinical use.

Critical appraisal

Strengths

- **Holistic synergy:** Multi-target coverage of infection control, inflammation, oxidative stress, angiogenesis, and remodeling.
- **Low toxicity:** Herbal and honey-based formulation reduces risks of cytotoxicity and resistance.
- **Classical validation:** Strong Ayurvedic foundation with direct textual support.

Limitations

- **Scarcity of *Ashtavarga* herbs:** *Jivaka* and *Ṛuṣhabhaka* are endangered, often substituted by *Pueraria tuberosa*; pharmacological equivalence requires further validation. [54]
- **Preclinical dominance:** Most data come from animal studies; few randomized controlled trials exist.
- **Standardization issues:** Variability in sourcing, preparation, and dosage forms may affect reproducibility.

Future scope of study

Further research should focus on clinical trials in chronic wounds, burns, and diabetic ulcers to validate *Himavan Agad*. Standardization of raw drugs, especially rare *Ashtavarga* herbs, along with development of novel dosage forms like gels and nanocarriers, will improve reproducibility and patient outcomes. Molecular studies on angiogenesis and collagen pathways may provide stronger mechanistic insights.

CONCLUSION

Himavan Agad, mentioned in *Aṣhṭanga Hridaya* and *Aṣhṭanga Sangraha*, shows antimicrobial, anti-inflammatory, antioxidant, and collagen-promoting effects that act synergistically across all wound-healing phases. Compared to modern topical agents, it offers a holistic and safer alternative. While current findings are encouraging, clinical validation and standardization remain essential for its integration into contemporary wound management.

Abbreviations

Spp. (Species)
COX Pathway (cyclooxygenase pathway)
ROS (reactive oxygen species)

REFERENCE:

1. Sushruta. *Sushruta Samhita*, Ayurveda Tatva Sandipika Commentary by Ambikadatta Shastri. Chapter 21, verse 40. Varanasi: Chaukhambha Sanskrit Series; 2007;164.
2. Shastri AD, (editor). *Sushruta Samhita*. Chikitsasthana chapter 1, verse no.8. Varanasi: Chaukhambha Sanskrit Series; 2008;7.
3. Martin P. Wound healing--aiming for perfect skin regeneration. *Science*. 1997;276(5309):75-81. doi: 10.1126/science.276.5309.75. Available from: https://pubmed.ncbi.nlm.nih.gov/9082989/
4. Singer AJ, Clark RA. Cutaneous wound healing. The New England Journal of Medicine (N Engl J Med). 1999 Sep 2;341(10):738-746. doi: 10.1056/NEJM199909023411006. PMID: 10471461. Available from: https://pubmed.ncbi.nlm.nih.gov/10471461/
5. Sen CK. Human wounds and its burden: an updated compendium of estimates. Advances in Wound Care (Adv Wound Care) (New Rochelle). 2019 Feb 1;8(2):39-48. doi: 10.1089/wound.2019.0946. PMID: 30809421; PMCID: PMC6389759.Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6389759/
6. Guo S, DiPietro LA. Factors affecting wound healing. Journal of Dental Research (J Dent Res). 2010 Mar;89(3):219-229. doi: 10.1177/0022034509359125. PMID: 20139336. Available from: https://pubmed.ncbi.nlm.nih.gov/20139336/
7. Atiyeh BS, Costagliola M, Hayek SN, Dibo SA. Effect of silver on burn wound infection control and healing: review of the literature. Burns. 2007 Mar;33(2):139-148. doi: 10.1016/j.burns.2006.06.010. PMID: 17137719. Available from: https://pubmed.ncbi.nlm.nih.gov/17137719/
8. Lansdown AB. Silver in health care: antimicrobial effects and safety in use. Current Problems in Dermatology (Curr Probl Dermatol). 2006:33:17-34. doi: 10.1159/000093928Available from: https://pubmed.ncbi.nlm.nih.gov/16766878/
9. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. UK Review on Antimicrobial Resistance; 2016. Available from: https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf
10. Bowler PG, Duerden BI, and Armstrong DG. Wound microbiology and associated approaches to wound management. Clinical Microbiology Reviews. 2001 Apr;14(2):244-269. doi: 10.1128/CMR.14.2.244-269.2001. PMID: 11292675. Available from: https://journals.asm.org/doi/10.1128/cmr.14.2.244-269.2001
11. Biswas TK, Mukherjee B. Plant medicines of Indian origin for wound healing activity: A review. International journal of lower extremity wounds (Int J Low Extrem Wounds). 2003 Mar;2(1):25-39. doi: 10.1177/1534734603002001006.Available from: https://pubmed.ncbi.nlm.nih.gov/15866825/
12. Boateng JS, Catanzano O. Advanced therapeutic dressings for effective wound healing--a review. Journal of Pharmaceutical Sciences (J Pharm Sci).2015 Nov;104(11):3653-3680. doi: 10.1002/jps.24610.Availablefrom: https://pubmed.ncbi.nlm.nih.gov/26308473/
13. WHO. Global priority list of antibiotic-resistant bacteria. Geneva: World Health Organization; 2017.Available from: https://www.who.int/publications/i/item/9789240093461
14. Tripathi B. (editor). *Ashtanga Hridaya of Vagbhata*. Uttarasthana chapter 36, verse 64,65; Delhi: Chaukhambha Sanskrit Pratisthan; 2009; 912.
15. Misra J, Sharma S. (editor). *Ashtanga Samgraha of Vriddha Vagbhata*. Chapter 42; verse 20; Varanasi: Chaukhambha Sanskrit Series; 2008;867.

16. Patil V V, Pimprikar R B, Patil V R. Pharmacognostical studies and evaluation of anti-inflammatory activity of *Ficus bengalensis* linn. J Young Pharmacists [serial online] 2009 [cited 2013 Apr 20]; 1:49-53. Available from: https://jyoungpharm.in/article.asp?issn=0975-1483;year=2009;volume=1;issue=1;spage=49;epage=53;aulast=Patil
17. Menezes C, G K, N R, D S. Analgesic and anti-inflammatory activities of Ficus glomeratain Experimental Animal Models. International Journal of Pharmaceutical Sciences and Nanotechnology (IJPSN). November 2011.DOI:10.37285/ijpsn.2011.4.3.10; Available from: https://www.ijpsnonline.com/index.php/ijpsn/article/view/444
18. Roy K, Shivkumar H, Sarkar S. Wound healing potential of leaf extracts of *Ficus religiosa*. International Journal of PharmTech Research (*Int J PharmTech Res).* 2009;1(3):506-510.Available from: https://www.researchgate.net/publication/237724099_Wound_Healing_Potential_of_Leaf_Extracts_of_Ficus_Religiosa_on_Wistar_albino_strain_rats
19. Sindhu R, Arora S. Anti-inflammatory potential of extracts isolated from roots of *Ficus lacor*. Archives of Biological Sciences (*Arch Biol Sci).* 2014;66(3): 1261-1270.DOI:10.2298/ABS1403261S Available from: https://doiserbia.nb.rs/Article.aspx?ID=0354-46641403261S
20. Kishore RN, Mangilal T, Anjaneyulu N, et al. Investigation of anti-inflammatory and invitro antioxidant activities of hydroalcoholic extract of bark of salix tetrasperma roxb. International journal on pharmaceutics and drug analysis (*Int J Pharm Drug Anal).* 2014; 2:506-509.Available from: https://ijpda.org/index.php/journal/article/view/78.
21. Li K, Diao Y, Zhang H, et al. Tannin extracts from immature fruits of *Terminalia chebula* promote cutaneous wound healing in rats. *BMC Complement Altern Med.* 2011; 11:86. PMID: 21982053; PMCID: PMC3198757;DOI: 10.1186/1472-6882-11-86 Available from: https://pubmed.ncbi.nlm.nih.gov/21982053/
22. Choudhary GP. Wound healing activity of ethanol extract of *Terminalia bellerica* fruits. Indian Journal of Natural Products and Resources *(IJNPR).* 2008;7(1):19-21. Available from: https://pubmed.ncbi.nlm.nih.gov/31494631/
23. Jain R, Pandey R, Mahant RN, Rathore DS. A review on medicinal importance of *Emblica officinalis*. International Journal of Pharmaceutical Sciences And Research (*Int J Pharm Sci Res).* 2015;6(1):72-84.DOI: http://dx.doi.org/10.13040/IJPSR.0975-8232.6(1).72-84 Available from: https://ijpsr.com/bft-article/a-review-on-medicinal-importance-of-emblica-officinalis/
24. Saeedi M, Semnani KM, Ghoreishi MR. Treatment of atopic dermatitis with licorice gel. Journal of Dermatological Treatment (*J Dermatol Treat).* 2003;14(3):153-157.PMID: 14522625 DOI: 10.1080/09546630310014369 Available from: https://pubmed.ncbi.nlm.nih.gov/14522625/
25. Choudhary GP. Wound healing activity of ethanolic extract of *Mesua ferrea* Linn. International journal of advances in pharmacy, biology and chemistry (*Int J Adv Pharm Biol Chem).* 2012;1:369-371.Available from: https://www.researchgate.net/publication/288644143_Wound_healing_activity_of_the_ethanolic_extract_of_Terminalia_chebula_Retz
26. Pedapati SHS, Khan MI, Prabhakar P, Giridhar P. Cyanidin-3-glucoside, nutritionally important constituents and in vitro antioxidant activities of Santalum album L. berries. Food Research International (*Food Res Int).* 2012;10:24.DOI:10.1016/j.foodres.2012.10.024Available from:https://www.academia.edu/27146683/Cyanidin_3_glucoside_nutritionally_important_constituents_and_in_vitro_antioxidant_activities_of_Santalum_album_L_berries
27. Sharma A, Reddy GD, Kaushik A, Tiwari RK, Mukherjee A, Rao CV. Analgesic and anti-inflammatory activity of Carissa carandas linn fruits and Microstylis wallichii lindl tubers. Natural Product Sciences, (*Nat Prod Sci).* 2007;13(1):6-10.Available from: https://www.researchgate.net/publication/290006386_Analgesic_and_anti-inflammatory_activity_of_Carissa_carandas_linn_fruits_and_Microstylis_wallichii_lindl_tubers
28. Dudhamal TS, Gupta SK, Bhuyan C. Role of honey (*Madhu*) in the management of wounds (*Dushta Vrana*). International Journal of ayurveda research (*Int J Ayurveda Res).* 2010;1(4): 271-273.doi: 10.4103/0974-7788.76793Available from:https://pmc.ncbi.nlm.nih.gov/articles/PMC3059452/
29. Molan PC. The role of honey in the management of wounds. Journal of Wound Care (*J Wound Care).* 1999;8(8):415-418.Available from: https://pubmed.ncbi.nlm.nih.gov/10808853/
30. Vandamme L, Heyneman A, Hoeksema H, et al. Honey in modern wound care: a systematic review. *Burns*. 2013;39(8):1514-1525.Available from: https://pubmed.ncbi.nlm.nih.gov/23896128/
31. Visavadia BG, Honeysett J, Danford MH. Manuka honey dressing: an effective treatment for chronic wound infections. British Journal of Oral and Maxillofacial Surgery (*Br J Oral Maxillofac Surg).* 2008;46(1):55-56. Available from: https://pubmed.ncbi.nlm.nih.gov/17113690/
32. Mandal MD, Mandal S. Honey: its medicinal property and antibacterial activity. Asian Pacific Journal of Tropical Biomedicine (*Asian Pac J Trop Biomed).* 2011;1(2):154-160.Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3609166/
33. Subramanian M, Gayathri R, Rathnavelu V, Dharmar P. Antioxidant activity of Triphala and its constituents.Journal of Ayurveda and Integrated Medical Sciences, (*Int J Pharm Pharm Sci).* 2013;5(4):623-628.Available from:https://jaims.in/jaims/article/view/122
34. Baliga MS. Triphala, Ayurvedic formulation for treating and preventing cancer: a review. The Journal of Alternative and Complementary Medicine (*J Altern Complement Med).* 2010;16(12):1301-1308.Available from: https://pubmed.ncbi.nlm.nih.gov/21138390/
35. Kumar A, Agarwal A, Khanna P, et al. Evaluation of wound healing activity of Triphala in albino rats. Indian Journal of Basic and Applied Medical Research (IJBAMR).2016;6(1):395-401Available from:https://www.ijbamr.com/assets/images/issues/pdf/December%202016%20395-401.pdf.pdf
36. Shukla A, Rasik AM, Dhawan BN. Asiaticoside-induced elevation of antioxidant levels in healing wounds. *Phytotherapy Research*. 1999;13(1):50-54. Available from: https://pubmed.ncbi.nlm.nih.gov/10189951/

37. Eming SA, Martin P, Tomic-Canic M. Wound repair and regeneration: mechanisms, signaling, and translation. Science Translational Medicine journal *(Sci Transl Med)*. 2014;6(265):Available from https://pmc.ncbi.nlm.nih.gov/articles/PMC4973620/
38. Schafer M, Werner S. Oxidative stress in normal and impaired wound repair. Pharmacological Research (*Pharmacol Res)*. 2008;58(2):165-171.Available from:https://www.sciencedirect.com/science/article/pii/S1043661808001072
39. Ferreira AM, Esposito CC, Coutinho-Netto J, et al. Oxidative stress and its association with wound healing: a review. World J Exp Med. 2016;6(3):37-43. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9232376/
40. Sen CK, Roy S. Redox signals in wound healing. Biochim Biophys Acta. 2008 Nov;1780(11):1348-61. doi: 10.1016/j.bbagen.2008.01.006. PMID: 18249195; PMCID: PMC2574682. Available from: https://pubmed.ncbi.nlm.nih.gov/18249195/
41. Velnar T, Bailey T, Smrkolj V. The wound healing process: an overview of the cellular and molecular mechanisms. J Int Med Res. 2009;37(5):1528-1542. Available here: https://pubmed.ncbi.nlm.nih.gov/19930861/
42. Gupta A, Upadhyay NK, Sawhney RC, Kumar R. Polyherbal formulation accelerates normal and impaired wound healing. Wound Repair and Regeneration *(WRR)*.2008;118(2):311-316.Available from: https://pubmed.ncbi.nlm.nih.gov/19128249/
43. Baragi UC, Ganer JM, Adulteration and Substitution of Herbal Drugs: A Critical Review of Challenges and Implications for Integrative Medicine. Journal of Ayurveda and Integrative Medicine (J Ayu Int Med Sci). 2025;10(7):1-4. Available from: https://jaims.in/jaims/article/view/4890
44. Upton R, Graff A, Jolliffe G. *American Herbal Pharmacopoeia: Terminalia chebula Monograph*. Scotts Valley, CA: AHP; 2018.Available from: https://herbal-ahp.org
45. Molan PC. Potential of honey in the treatment of wounds and burns.American Journal of Clinical Dermatology (*Am J Clin Dermatol)*. 2001;2(1):13-19. Available from: https://pubmed.ncbi.nlm.nih.gov/11702616/
46. Al-Waili NS, Salom K, Al-Ghamdi AA. Honey for wound healing, ulcers, and burns: data supporting its use in clinical practice. *Scientific World Journal*. 2011; 11:766-787.available from: https://pubmed.ncbi.nlm.nih.gov/21479349/
47. Gupta A, Upadhyay NK, Sawhney RC, Kumar R. A polyherbal formulation accelerates normal and impaired wound healing. Wound Repair and Regeneration.2008;118(2):311-316.Available from: https://pubmed.ncbi.nlm.nih.gov/19128249/
48. Tanimu H, Vijayan NK, Sukumaran BO. Polyherbal Formulation Approach: A Promising Wound Healing Strategy. International Journal of Life Science and Pharma Research (Int J Life Sci Pharma Res). 2022;12(5):126-142. Available from: https://www.ijlpr.com/index.php/journal/article/view/1331
49. Martin P, Nunan R. Cellular and molecular mechanisms of repair in acute and chronic wound healing. *British Journal of Dermatology (Br J Dermatol)*. 2015;173(2):370-378.Available from: https://pubmed.ncbi.nlm.nih.gov/26175283/
50. Eming SA, Krieg T, Davidson JM. Inflammation in wound repair: molecular and cellular mechanisms. *Journal of Investigative Dermatology (J Invest Dermatol)*. 2007;127(3):514-525.Available from: https://pubmed.ncbi.nlm.nih.gov/17299434/
51. Rezaie A, Parker RD, Abdollahi M. Oxidative stress and pathogenesis of inflammatory bowel disease: an epiphenomenon or the cause? Digestive Diseases and Sciences (*Dig Dis Sci)*. 2007;52(9):2015-2021.available from: https://pubmed.ncbi.nlm.nih.gov/17404859/
52. Poon VKM, Burd A. In vitro cytotoxicity of silver: implication for clinical wound care. Burns. 2004 Mar;30(2):140-7. Available from: https://pubmed.ncbi.nlm.nih.gov/15019121/
53. Polcz ME, Barbul A. The Role of Vitamin A in Wound Healing. Nutrition in Clinical Practice (Nutr Clin Pract). 2019 Oct;34(5):695-700. Available from: https://pubmed.ncbi.nlm.nih.gov/31389093/
54. Steinstraesser L, Kraneburg UM, Jacobsen F, Al-Benna S. Innate Defense Regulator Peptide 1018 in Wound Healing. PLoS One. 2012 Aug 5;7(8): e39373. Available from: https://pubmed.ncbi.nlm.nih.gov/22879874/
55. Raina R, Prawez S, Verma PK, Pankaj NK. Medicinal Plants and their Role in Wound Healing. Vet Scan. 2008; 3:1. Available from: https://journal.vetscan.co.in/index.php/vs/article/view/28
56. Akbik D, Ghadiri M, Chrzanowski W, Rohanizadeh R. Curcumin as a wound healing agent. Life Sciences (Life Sci). 2014 Oct 22;116(1):1-7. Available from: https://pubmed.ncbi.nlm.nih.gov/25200875/
57. Hess CT. Checklist for factors affecting wound healing. *Adv Skin Wound Care*. 2011;24(4):192-200.available from: https://pubmed.ncbi.nlm.nih.gov/21422844/
58. D'Avignon LC, Hogan BK, Murray CK, Loo FL, et al. Contribution of bacterial and viral infections to attributable mortality in patients with severe burns: an autopsy series. Burns. 2010 Sep;36(6):773-9. Available from: https://pubmed.ncbi.nlm.nih.gov/20074860/
59. Nakamura Y, Daya M. Use of appropriate antimicrobials in wound management. Emergency Medicine Clinics of North America (Emerg Med Clin North Am). 2007 Feb;25(1):159-76. Available from: https://pubmed.ncbi.nlm.nih.gov/17400079/
60. Schultz GS, Barillo DJ, Mozingo DW, Chin GA; Wound Bed Advisory Board Members. Wound bed preparation and a brief history of TIME. International Wound Journal (Int Wound J). 2004 Apr;1(1):19-32. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7951422/
61. Zinder R, Cooley R, Vlad LG, Molnar JA. Nutrition and wound healing. *Nutr Clin Pract*. 2019;34(6):839-849.Available from https://pubmed.ncbi.nlm.nih.gov/31697447/
62. Molan PC. The antibacterial activity of honey. Variation in potency of antibacterial activity. *Bee World*. 1992;73(2):59-76.available from: https://www.tandfonline.com/doi/abs/10.1080/0005772X.1992.11099118
63. Dudhamal TS. Review of grey literature on Ayurveda wound healing formulations and procedures: A systematic analysis. AYU. 2023;44(4):159-176. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10424143/
64. Tashkandi H. Honey in wound healing: An updated review. Open Life Sci. 2021 Oct 6;16(1):1091–1100. doi: 10.1515/biol-2021-0084. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8496555/
65. Talekar YP, Kadam AV, Giri AP,et al.Studies on wound healing potential of polyherbal formulation. Pharmacogn Res. 2017 Jun 6;9(3):263-270. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5497006/