IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Identification And Therapeutic Applications Of Medicinal Leeches (Alaq) In Unani Medicine: A Traditional And Modern Perspective

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**ABSTRACT**

Irsale Alaq (leech therapy) is a cornerstone of regimenal therapy (Ilaj-bil-Tadbeer) in the Unani system of medicine, traditionally employed for the targeted evacuation of morbid humours (Khalte Fasid) from diseased sites. Its principle is based on diverting morbid material (Imala-e-Mawad) to restore the body's innate balance (Tabiat). After a period of decline in the West, Leech therapy (Irsaal-e-Alaq) has experienced a renaissance in modern medicine, particularly in microsurgery and reconstructive procedures, prompting a re-evaluation of its traditional principles through the lens of contemporary science. This systematic review aims to critically synthesize the traditional Unani principles of Irsale Alaq with current scientific evidence on its mechanisms and clinical efficacy. A comprehensive literature search was conducted following PRISMA 2020 guidelines across electronic databases (PubMed, Scopus, Web of Science, Cochrane Library) and repositories of Unani literature (CCRUM, Jamia Hamdard) until December 2023.

Findings demonstrate a remarkable congruence between Unani knowledge and modern science. The classical classifications of Alaq-e-Kabir and Alaq-e-Saghir correspond to the species **Hirudo medicinalis** and **Hirudinaria granulosa**, respectively. The therapeutic effects, empirically observed for centuries, are now known to be mediated by a complex cocktail of bioactive compounds in leech saliva, including hirudin (a potent anticoagulant), hyaluronidase (a spreading factor), eglins (anti-inflammatory agents), and vasodilators. This pharmacological profile validates its traditional use and underpins its modern applications in managing venous congestion, osteoarthritis, varicose veins, and other

inflammatory conditions. Irsale Alaq thus stands as a paradigm for the integration of traditional wisdom with evidence-based medicine, offering a safe and effective non-pharmacological treatment modality with significant potential for wider adoption in mainstream healthcare.

**KEYWORDS**: Leech therapy (Irsaal-e-Alaq), Unani Medicine, **Hirudo medicinalis**, **Hirudinaria granulosa**, Hirudin, Humoral Theory, Khalte Fasid, Regimenal Therapy, Hirudotherapy.

## INTRODUCTION

Leech therapy (Irsale Alaq), or Hirudotherapy, is one of the most ancient medical practices, with documented use in ancient Egyptian, Indian, and Greek civilizations[1]. Within the Unani system of medicine—a holistic science founded upon the teachings of Hippocrates (460–377 BC) and Galen (129–216 AD) and later refined by illustrious physicians like Ibn Sina (Avicenna, 980–1037 AD) and Al-Razi (Rhazes, 854–925 AD)—this modality is known as Irsale Alaq[2]. It is considered a specialized form of venesection (Fasd), distinguished by its precision in evacuating morbid humours (Khalte Fasid) from a specific pathological site without damaging blood vessels, operating on the principle of Imala-e-Mawad (diversion of morbid material)[3].

The decline of Leech therapy (Irsaal-e-Alaq) in the West began in the late 19th century with the advent of modern pharmacology and a paradigm shift towards evidence-based practice[6]. However, its serendipitous and successful application in the 1960s to salvage venous-congested tissue flaps and reattached digits in plastic and reconstructive surgery marked a pivotal turning point, sparking a modern renaissance[7]. This clinical success catalyzed intensive scientific inquiry into the biological mechanisms underlying its efficacy, leading to the identification of a plethora of bioactive compounds in leech saliva.

This systematic review, therefore, seeks to construct a robust bridge between the historical wisdom of Unani medicine and the rigorous validation of contemporary science. It aims to achieve this by:

**1.** Elucidating the traditional Unani principles of Irsale Alaq, including the identification of species, humoral basis, and therapeutic applications.

**2.** Critically examining modern scientific evidence on the pharmacological mechanisms and clinical efficacy of Leech therapy (Irsaal-e-Alaq) across a spectrum of diseases.

**3.** Synthesizing these two perspectives to highlight points of convergence and validate Irsale Alaq as a credible, evidence-based therapeutic intervention.

## DATA COLLECTION AND ANALYSIS

This review was conducted in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement to ensure a transparent and reproducible methodology[12].

### Data Sources and Search Strategy

A dual-strategy approach was employed to capture the entirety of relevant knowledge, encompassing both classical Unani literature and modern biomedical research.

- **Classical Unani Texts:** A thorough manual search was conducted of foundational Unani texts, including:

- **Al-Qanun fi al-Tibb** (The Canon of Medicine) by Ibn Sina[4].

- **Al-Hawi fi al-Tibb** (The Comprehensive Book of Medicine) by Al-Razi[5].

- **Zakhira Khwarazm Shahi** (The Treasure of Khwarazm Shah) by Ismail Jurjani[13].

These sources were consulted in their original Arabic and Persian, as well as available Urdu and English translations, to extract data on leech species, morphological identification, therapeutic indications, contraindications, application procedures, and the underlying humoral pathology.

- **Electronic Databases:** A systematic electronic search was performed from inception until December 2023 across the following databases: PubMed, Scopus, Web of Science, Cochrane Library, Google Scholar, and the AYUSH Research Portal. The search strategy utilized a combination of Medical Subject Headings (MeSH) and free-text keywords, including: ("Unani Medicine" OR "Traditional Medicine") AND ("Irsale Alaq" OR "Leech Therapy" OR "Hirudotherapy") AND ("Hirudo medicinalis" OR "Hirudinaria granulosa") AND ("Hirudin" OR "Salivary peptides"). Boolean operators (AND, OR) were used to refine the search.

**Data Extraction**

The study selection process involved a two-stage screening by two independent reviewers to minimize bias.

- **Data Extraction:** A standardized data extraction form was used to collate information on: first author, publication year, study design, sample characteristics, leech species, intervention details, control groups, primary outcomes (efficacy), and adverse events (safety).

**Quality Assessment and Data Synthesis**

The methodological quality of included randomized controlled trials (RCTs) was assessed using the Cochrane Risk of Bias (RoB 2) tool. For non-randomized studies, the Joanna Briggs Institute (JBI) critical appraisal checklists were employed. Given the significant clinical and methodological heterogeneity among the included studies, a meta-analysis was deemed unfeasible. Consequently, a narrative synthesis was conducted, organizing the findings into thematic categories: Unani Principles, Modern Pharmacology, Clinical Applications, and Safety Considerations.

## RESULTS

### The Unani System of Leech Therapy (Irsale Alaq)

The Unani perspective on Irsale Alaq is a comprehensive system deeply entrenched in humoral theory (Figure 1).

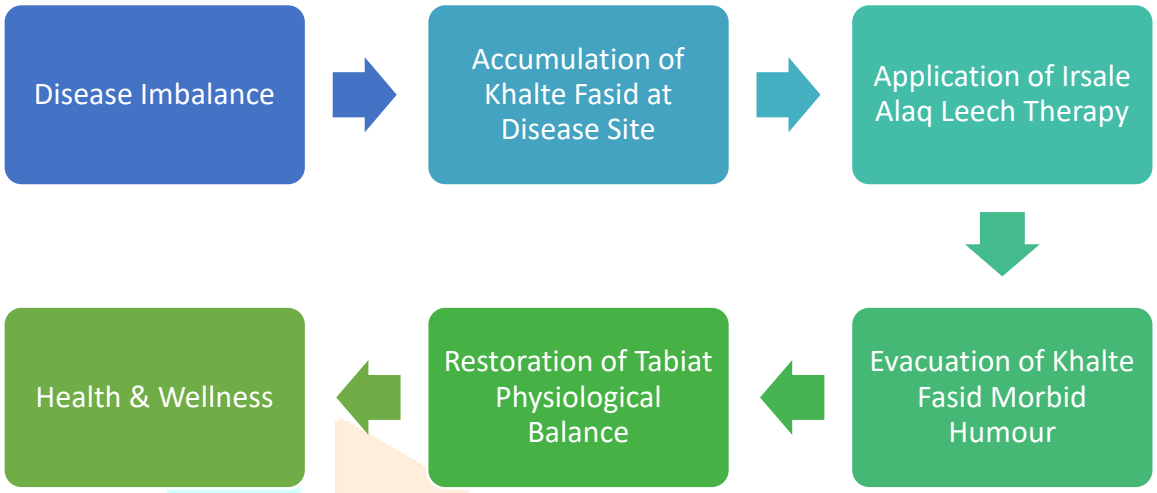


**Figure 1**

- **Taxonomy and Identification**: In the absence of modern Linnaean taxonomy, Unani scholars exhibited exceptional observational acumen. They classified leeches primarily based on size and habitat into **Alaq-e-Kabir** (large leech) and **Alaq-e-Saghir** (small leech)[4,13]. Contemporary biology identifies these as **Hirudo medicinalis** (European medicinal leech) and **Hirudinaria granulosa** (Asian/Indian medicinal leech), respectively[14]. Meticulous descriptions were provided for selecting therapeutic-grade leeches: they should be medium-sized, soft-bodied, greenish-black, and agile, inhabiting clean, fast-flowing freshwater bodies. Leeches from stagnant, polluted water—described as thick, dark, and sluggish—were strictly prohibited due to associated health risks[4,13], an early recognition of hygiene and infection control.

- **Pathophysiological Basis and Mechanism:** The fundamental premise of Irsale Alaq is the removal of **Khalte Fasid** (morbid humour) from a specific diseased site. This morbid matter, often described as dark, viscous, and putrefied blood, is believed to be a key etiological factor in disease pathogenesis, causing obstruction, inflammation, and pain. By drawing this corrupt humour out, the procedure aims to remove the cause of disease, facilitate the inflow of healthy blood, and restore the body's natural healing capacity (Tabiat) and humoral equilibrium[3,5]. The principle of **Imala-e-Mawad** (diversion of material) is central, as the therapy draws the morbid matter from deeper tissues to the surface for evacuation.

- **Therapeutic Indications:** Classical texts prescribe Irsale Alaq for a wide array of conditions, reflecting its role in treating localized inflammation and congestion. These include, but are not limited to:

- **Musculoskeletal Disorders: Waja al-Mafasil** (joint pain, arthritis), gout, inflammatory swellings.
- **Dermatological Conditions:** Eczema, acne, chronic ulcers, boils, and skin infections.
- **Vascular Disorders:** Haemorrhoids (Bawaseer), varicose veins.
- **Neurological Conditions:** Headaches, migraines.
- **Other**: Ocular diseases like conjunctivitis and inflammatory conditions of other organs[4,5,13].

- **Application Protocol:** The application is a precise ritual. The affected site is cleansed with warm water or, in some cases, milk to attract the leech. A hungry leech is then applied directly. It is allowed to engorge fully and detach naturally, a process typically taking 20-45 minutes. The subsequent bleeding from the wound for several hours is considered therapeutic and is encouraged. Detachment, if necessary, is facilitated by applying stimuli like turmeric, salt, or vinegar[4,15].

- **Contraindications:** Reflecting a sophisticated understanding of patient safety, Unani texts explicitly contraindicate Irsale Alaq in individuals with Faqr-ud-Dam (severe anemia), profound Za'f (debility), cachexia, Mizaj Barid (cold temperament), and during pregnancy[4,5].

## Modern Scientific Validation of Leech Therapy

Modern research has deconstructed the empirical success of Leech therapy (Irsaal-e-Alaq), providing a detailed molecular and physiological explanation for its effects (Table 1).

**Table 1:** Key Bioactive Compounds in Medicinal Leech Saliva and Their Pharmacological Actions

| Compound / Enzyme Group | Primary Function | Mechanism of Action | Biological Effect |
|---|---|---|---|
| **Hirudin** | Direct Thrombin Inhibitor | Binds irreversibly to thrombin, blocking fibrin formation and platelet activation. | Potent anticoagulation; prevents secondary hemostasis. |
| **Calin** | Platelet Aggregation Inhibitor | Blocks collagen-mediated platelet adhesion and aggregation. | Sustains bleeding; prevents primary hemostasis. |
| **Destabilase** | Fibrinolytic Enzyme | Dissolves fibrin through iso-peptidase and lysozyme activity. | Breaks down existing blood clots; anti-thrombotic. |
| **Hyaluronidase** | Spreading Factor | Hydrolyses hyaluronic acid in connective tissue. | Increases tissue permeability, facilitating diffusion of other salivary compounds. |
| **Eglins (Eglin C)** | Protease Inhibitor | Inhibits neutrophil-derived proteases (elastase, cathepsin G). | Potent anti-inflammatory; reduces tissue damage. |
| **Bdellins** | Protease Inhibitor | Inhibits plasmin and trypsin. | Anti-inflammatory and anti-edematous effects. |
| **Histamine-like Substances** | Vasodilator | Binds to histamine receptors on capillary endothelium. | Increases local blood flow and microcirculation; decongestant. |
| **Anesthetics** | Local Anesthetic | Unidentified compounds that block nerve signals. | Renders the bite virtually painless. |

- **Pharmacological Basis:** The leech saliva is a veritable treasure trove of pharmacologically active substances. Over 100 bioactive compounds have been identified, which work in a potent synergistic manner. The combined effect is a powerful **anticoagulant, anti-inflammatory, analgesic, and decongestant** cocktail, delivered directly into the microcirculation of the affected tissue[9,11,19].

- **Clinical Evidence and Applications:** Modern clinical practice has validated and refined the use of Leech therapy (Irsaal-e-Alaq) in several key areas (Table 2).

**Table 2:** Summary of Clinical Evidence for Leech Therapy

| Condition Treated | Study Design | Key Findings / Outcome | Reference |
|---|---|---|---|
| **Venous Congestion in Reconstructive Surgery** | Multiple Case Series & Reviews | 85-95% salvage rate of compromised tissue flaps and reattached digits; rapid decongestion within 24-72 hours. | [7, 20, 25] |
| **Knee Osteoarthritis (OA)** | Randomized Controlled Trials (RCTs) | Significant reduction in pain (VAS score), improved stiffness, and enhanced physical function (WOMAC index) compared to topical diclofenac or placebo. Effects sustained for several weeks. | [21, 22] |
| **Varicose Veins & Thrombophlebitis** | Case Reports & Pilot Studies | Marked reduction in pain, heaviness, tension, and local inflammation; improved cosmetic appearance. | [23] |
| **Migraine and Tension Headache** | Pilot Studies | Promising reduction in headache intensity, frequency, and duration, potentially via anti-inflammatory and decongestant effects on cranial vessels. | [24] |
| **Dermatological Conditions (e.g., Psoriasis, Chronic Ulcers)** | Case Series | Observations of reduced scaling, inflammation, and promotion of healing in chronic wounds; requires further controlled studies. | [11, 18] |

- **Modern Clinical Protocol and Safety:** In a modern clinical setting, Leech therapy (Irsaal-e-Alaq) is a controlled procedure. It is performed under strict aseptic conditions. The primary safety concern is infection from Aeromonas hydrophila, a symbiotic bacterium residing in the leech's gut. This is proactively managed by administering prophylactic antibiotics (e.g., fluoroquinolones) to the patient for the duration of therapy[15,25]. Modern contraindications perfectly mirror traditional ones: anemia, coagulopathies, immunosuppression, arterial disease, and pregnancy.

## DISCUSSION

This systematic review elucidates a profound and detailed congruence between the ancient wisdom of Unani medicine and the empirical findings of modern science regarding leech therapy.

### Validation of Traditional Knowledge through Science

The Unani classification of leeches, though pre-Linnaean, demonstrates remarkable ecological and morphological accuracy. The cautions against using leeches from polluted water find their direct correlate in the modern management of **Aeromonas** infection, showcasing an early understanding of public health hygiene.

### The Humoral-Molecular Bridge: Decoding the Mechanism

The most significant convergence lies in the explanation of Leech therapy's (Irsaal-e-Alaq) mechanism. The Unani concept of **Khalte Fasid** is not a metaphysical abstraction but finds a robust correlate in the modern pathophysiology of inflammation, ischemia, and congestion. The dark, viscous blood described by Unani physicians is likely deoxygenated, hypercoagulable blood rich in inflammatory mediators, characteristic of a congested and hypoxic tissue bed.

The leech's salivary secretions provide a precise multi-targeted biochemical intervention:

- **Anticoagulation and Fibrinolysis (Hirudin, Calin, Destabilase):** This complex action effectively **evacuates** the stagnant, coagulable blood, directly fulfilling the Unani objective of removing morbid humour. The prolonged bleeding is not a side effect but the core therapeutic action.

- **Improved Perfusion (Vasodilators, Hyaluronidase):** By increasing local blood flow and tissue permeability, these compounds enact the Unani principle of **Imala-e-Mawad**, diverting healthy circulation to the afflicted site and resolving congestion.

- **Resolution of Inflammation and Pain (Eglins, Bdellins, Anesthetics):** By inhibiting key proteases and inflammatory pathways, these substances rapidly reduce swelling, redness, and pain. This provides a scientific basis for the Unani observation of reduced **waram** (inflammation) and waja (pain) post-therapy.

### Clinical Convergence and Expanded Horizons

The modern adoption of Leech therapy (Irsaal-e-Alaq) in plastic surgery is a direct, high-stakes application of the Unani principle of relieving localized congestion (**Imtila**). Similarly, its proven efficacy in osteoarthritis validates its traditional use for **Waja al-Mafasil**. Emerging research into migraine and dermatology suggests that the full scope of traditional indications may yet be validated.

### Safety and Future Directions

The alignment of traditional and modern contraindications underscores a universal principle of patient safety. The modern addition of antibiotic prophylaxis has significantly enhanced the risk-benefit profile. Future research must focus on standardizing protocols (species, duration, number of leeches), conducting high-quality RCTs for non-surgical indications, and exploring the immense potential of leech saliva compounds for novel drug discovery, such as designing synthetic hirudin analogs or multi-target anti-inflammatory drugs.

## CONCLUSION

Leech therapy (Irsale Alaq) stands as a powerful testament to the enduring validity of certain traditional medical practices. This review demonstrates that the principles enshrined in Unani literature—targeted evacuation of morbid humour to restore physiological balance—are not merely historical anecdotes but are pre-scientific insights that accurately describe a complex bio-therapeutic intervention. The leech itself functions as a sophisticated, living "micro-pharmacy," its salivary secretions providing a synergistic blend of anticoagulant, anti-inflammatory, and vasoactive agents that perfectly address the pathophysiology of congestion and inflammation. The successful integration of Leech therapy (Irsaal-e-Alaq) into modern hospitals, from reattaching fingers to treating arthritic knees, underscores its timeless therapeutic value. It is a compelling paradigm for the integration of traditional knowledge systems with modern scientific inquiry, arguing powerfully for a continued dialogue to explore, validate, and harness ancient healing arts for the future of global health.

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