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Review Article

" EFFICACY OF AYURVEDIC FORMULATIONS IN TREATING DIABETIC FOOT ULCERS: A REVIEW OF ARAGVADHADI GANA AND GHRUT"

Dr. Chetan Agrawal¹ Dr Kamlakar vasant Gajare²

1. Ph.D. Scholar, Department of Shalya Tantra, Sumatibhai Shah Ayurved Mahavidyalaya Hadpsar Pune.
2. Associate Professor, Department of Shalya Tantra, Sumatibhai Shah Ayurved Mahavidyalaya Hadpsar pune.

Address for correspondence:

Dr. Chetan Agrawal, Ph.D. Scholar, Department of Shalya Tantra, Sumatibhai Shah Ayurved Mahavidyalaya Hadpsar Pune.

Email Id: Dr.chetanpagrawal@gmail.com

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ABSTRACT

Background: Diabetic foot ulcers (DFUs) are a major complication of diabetes, often resulting in high morbidity and potential amputations if not treated properly. Conventional treatments, such as antibiotics, debridement, and advanced wound dressings, have limitations related to wound healing, recurrence, and infection control.

Objective: This review aims to evaluate the efficacy of Ayurvedic formulations, specifically Aragvadhadi Gana (oral) and Aragvadhadi Ghrut (topical), in the management of DFUs. It compares the outcomes of these Ayurvedic treatments with conventional therapies and highlights their potential advantages in wound healing.

Methods: A comprehensive review of clinical trials and observational studies was conducted. Data on the therapeutic properties of Aragvadhadi Gana and Aragvadhadi Ghrut, such as antimicrobial, anti-inflammatory, and tissue-regenerative effects, were analyzed. The healing rates, infection control, and recurrence prevention in DFUs treated with these Ayurvedic formulations were compared to conventional treatment methods.

Results: The reviewed studies indicate that Aragvadhadi Gana and Aragvadhadi Ghrut significantly improved wound healing rates and reduced complications such as infections and recurrences in DFUs. These formulations demonstrated comparable or superior outcomes in some cases compared to conventional treatments, especially in promoting tissue regeneration and controlling infection.

Conclusion: Aragvadhadi Gana and Aragvadhadi Ghrut show promise as effective Ayurvedic alternatives or complementary therapies in DFU management. However, more extensive clinical trials are necessary to confirm their long-term efficacy and establish their role in modern wound care strategies, particularly where conventional treatments are less effective or inaccessible.

Introduction

Background of Diabetic Foot Ulcers (DFUs)

Diabetic foot ulcers (DFUs) are a common and debilitating complication of diabetes, affecting a significant portion of the diabetic population worldwide. These chronic open wounds typically occur on the feet, particularly in individuals who have poorly controlled blood glucose levels. DFUs are most often found on pressure points, such as the heels, toes, and the soles of the feet, where the risk of injury and trauma is high. The pathogenesis of DFUs is multifactorial, with

the primary contributing factors being poor circulation, neuropathy, and immune dysfunction. Poor circulation, or peripheral arterial disease (PAD), leads to reduced blood flow to the extremities, which impairs the delivery of oxygen and nutrients to the wound site, thereby delaying the healing process. Neuropathy, which is common in diabetic patients, results in the loss of sensation, making individuals unaware of minor injuries that can subsequently develop into chronic ulcers. Moreover, immune dysfunction in diabetes impairs the body's ability to fight infections, making DFUs highly susceptible to bacterial contamination, which exacerbates the condition and delays healing. As a result, DFUs are at a higher risk for infection, tissue necrosis, and even amputation if left untreated.

The prevalence of DFUs is alarmingly high, with approximately 25% of individuals with diabetes developing foot ulcers during their lifetime. The global rise in diabetes cases has directly contributed to the increasing incidence of DFUs, leading to a growing healthcare burden. These ulcers not only affect the physical health of individuals but also have a significant psychological and emotional impact. Individuals with DFUs often experience a diminished quality of life due to chronic pain, mobility issues, and the risk of further complications. The challenges in managing DFUs are numerous, ranging from high recurrence rates to the need for long-term, often complex care. Left untreated or poorly managed, DFUs can result in severe complications, including gangrene, osteomyelitis, and amputation. In fact, it is estimated that 20% of individuals with DFUs will eventually require amputation, making it one of the leading causes of non-traumatic lower-limb amputations worldwide. This underscores the urgent need for effective management strategies to improve patient outcomes and reduce the associated morbidity.

Current Treatment Approaches

The treatment of diabetic foot ulcers involves a comprehensive approach that aims to address the underlying causes of the ulcers, control infection, and promote wound healing. Conventional treatment methods focus on infection control, removal of necrotic tissue (debridement), and the use of advanced wound care dressings, such as hydrocolloids, foams, and silver-based dressings. Antibiotics are frequently prescribed to manage infections, and in more severe cases, surgical intervention may be required to remove infected or necrotic tissue. However, despite the availability of these treatments, the management of DFUs remains challenging. Many ulcers fail to heal within a reasonable time frame, and there is a high rate of recurrence. Additionally, the prolonged use of antibiotics raises concerns regarding antibiotic resistance, which can further complicate treatment. The use of advanced wound care technologies, although effective in some cases, is often associated with high costs, which may limit accessibility for some patients, particularly in low-resource settings. One of the significant challenges in treating DFUs is delayed wound healing, which can be attributed to multiple factors, including poor blood flow, infection, and chronic inflammation. The healing process in diabetic patients is often prolonged due to impaired collagen synthesis, reduced angiogenesis, and a higher likelihood of infection. This makes DFU treatment an ongoing challenge for healthcare providers. Furthermore, even when ulcers heal, they tend to recur, especially if the underlying factors, such as uncontrolled blood sugar, neuropathy, and poor circulation, are not effectively managed. As a result, there is an increasing interest in alternative therapies that can complement conventional treatments, particularly those that can enhance the body's natural healing processes and address the root causes of DFUs, such as poor circulation and immune dysfunction.

Introduction to Ayurvedic Medicine

Ayurveda, one of the oldest systems of medicine, originated in India over 5,000 years ago and is based on the principle of balancing the body's vital energies, or doshas—Vata, Pitta, and Kapha. According to Ayurvedic philosophy, health is achieved when these energies are in equilibrium, and disease results from imbalances in these forces. Ayurveda emphasizes a holistic approach to health, focusing not only on treating symptoms but also on addressing the root causes of disease and promoting overall well-being. For chronic wounds such as diabetic foot ulcers, Ayurveda offers natural remedies that aim to restore the body's balance and enhance its innate healing abilities. Ayurvedic treatments often involve the use of herbal formulations that possess antimicrobial, anti-inflammatory, and regenerative properties, making them particularly well-suited for managing chronic conditions like DFUs.

In the context of wound healing, Ayurveda views chronic ulcers, such as those found in diabetes, as *Dushta Vrana*—a term used to describe wounds that fail to heal due to an imbalance in the body's doshas. Ayurvedic treatments for *Dushta Vrana* involve the application of natural herbs and compounds that support healing by addressing underlying issues such as poor circulation, inflammation, and infection. These treatments are also designed to strengthen the body's immune system, enhance tissue regeneration, and promote overall wellness, which can ultimately contribute to faster and more effective wound healing.

The holistic nature of Ayurvedic medicine makes it an appealing complementary therapy to conventional treatments for DFUs. Ayurvedic treatments aim to work in synergy with the body's natural healing mechanisms, improving not only the wound but also the overall health of the individual.

Aragvadhadi Gana and Ghrit

One of the most promising Ayurvedic formulations for treating diabetic foot ulcers is *Aragvadhadi Gana*. This formulation is a blend of various herbs, including *Aragvadhā* (*Cassia fistula*), *Haridra* (*Curcuma longa*), and *Neem* (*Azadirachta indica*). These herbs have long been used in traditional Ayurvedic medicine for their potent antimicrobial,

anti-inflammatory, and wound-healing properties. Aragvadha, commonly known as the Indian laburnum, is known for its ability to cleanse the body of toxins, while Haridra (turmeric) is a powerful anti-inflammatory and antimicrobial agent that helps reduce infection and promote tissue regeneration. Neem, often referred to as the “village pharmacy,” has well-established antimicrobial and immune-boosting properties, making it an ideal herb for wound healing.

Aragvadhadi Ghrut, on the other hand, is a medicated ghee formulation that is applied topically to the wound. Ghee, a clarified butter, is considered an excellent medium for enhancing the absorption of medicinal herbs, allowing for faster and more effective healing. The combination of these herbs in ghee not only promotes wound healing but also reduces inflammation and prevents infection, addressing several of the key challenges in managing DFUs. These formulations have been used in traditional Ayurvedic practice for centuries, and their potential efficacy in modern diabetic wound care has been explored in recent studies. Their antimicrobial, anti-inflammatory, and regenerative effects make them a promising option for patients with chronic ulcers.

Significance of the Review

Given the rising global incidence of diabetes and the limitations of conventional DFU treatments, exploring alternative therapies like Aragvadhadi Gana and Aragvadhadi Ghrut is of considerable importance. While conventional treatments are effective to some extent, they often face challenges such as delayed healing, high recurrence rates, and complications like antibiotic resistance. Ayurvedic formulations, with their holistic and natural approach, have the potential to provide complementary benefits to conventional therapies. This review aims to analyze the available evidence on the efficacy of Aragvadhadi Gana and Aragvadhadi Ghrut in treating DFUs, compare them with conventional treatments, and explore their potential role in modern wound care. As the global burden of diabetes and related complications continues to rise, the need for effective, accessible, and affordable treatments for DFUs has never been more critical. This review will contribute to a better understanding of Ayurvedic therapies and their potential to improve the management of diabetic foot ulcers, offering an integrative approach to wound healing that combines the strengths of both traditional and modern medicine.

Aim and Objectives

The aim of this review is to evaluate the efficacy of Ayurvedic formulations Aragvadhadi Gana and Aragvadhadi Ghrut in the treatment of diabetic foot ulcers (DFUs), drawing insights from clinical trials and observational studies. This review seeks to provide a comprehensive understanding of the potential therapeutic benefits of these formulations, especially in the context of modern wound care practices. One of the key objectives is to thoroughly review the current literature on the management of diabetic foot ulcers, analyzing the different treatment modalities and their effectiveness in promoting wound healing and preventing complications. Another objective is to delve into the therapeutic properties of Aragvadhadi Gana and Aragvadhadi Ghrut, focusing on their antimicrobial, anti-inflammatory, and regenerative effects, and how these properties contribute to improved healing in chronic diabetic wounds. The review also aims to compare the clinical outcomes of these Ayurvedic treatments with those of conventional therapies, such as antibiotics and advanced wound dressings, to evaluate their relative advantages and limitations in DFU management. Lastly, an important objective of this review is to assess the safety and efficacy of Aragvadhadi Gana and Aragvadhadi Ghrut, considering factors such as healing time, infection control, side effects, and recurrence rates, with the goal of providing evidence-based recommendations for their integration into current wound care protocols.

Inclusion Criteria

The studies selected for this review were primarily clinical trials, observational studies, and case studies that investigated the use of Aragvadhadi Gana and Aragvadhadi Ghrut in the treatment of diabetic foot ulcers (DFUs). These studies were chosen based on their relevance to the therapeutic application of these Ayurvedic formulations for DFUs, which include both oral and topical administration. The inclusion criteria specifically focused on studies that:

1. Evaluated the effectiveness of Aragvadhadi Gana and Aragvadhadi Ghrut in managing DFUs.
2. Contained data on wound healing, including parameters like wound closure rates, infection control, and the reduction of complications associated with DFUs.
3. Provided clinical evidence of the safety and efficacy of these formulations.
4. Were published in peer-reviewed journals or reputable conference proceedings within the last 10 years to ensure the inclusion of recent and relevant data.
5. Involved human subjects, preferably adults with confirmed diagnoses of diabetes mellitus and DFUs.

Exclusion criteria included studies that were not focused on DFUs, those that lacked clear methodological designs (e.g., non-controlled studies or anecdotal evidence), or studies that did not provide sufficient outcome measures to assess the efficacy of the Ayurvedic formulations.

Search Strategy

To gather relevant studies for the review, an extensive search was conducted across multiple databases, including PubMed, Google Scholar, and Ayurvedic medical sources. The search strategy involved using specific keywords and phrases related to diabetic foot ulcers and Ayurvedic formulations. The following keywords were used:

- "Diabetic foot ulcer"

- "Aragvadhadi Gana"
- "Aragvadhadi Ghrut"
- "Ayurvedic treatment for wounds"
- "Dushta Vrana" (chronic wounds in Ayurvedic medicine)

The search was not limited by publication date, but priority was given to studies published within the past decade to ensure the inclusion of the most up-to-date research. The search was also broadened to include Ayurvedic journals and databases specific to traditional medicine, where studies on Ayurvedic formulations might have been published. The references of selected articles were cross-referenced to identify additional studies, following a snowballing approach to ensure a comprehensive review.

Data Extraction

Once the relevant studies were identified, data extraction was performed systematically to compile key information necessary for analysis. The extracted data included:

1. **Study Design:** This encompassed details on the type of study (e.g., randomized controlled trials, observational studies, or case studies), the number of participants, study duration, and methodology used to assess the outcomes of treatment with Aragvadhadi Gana and Aragvadhadi Ghrut.
2. **Sample Size:** The number of participants in each study was recorded to evaluate the statistical power and generalizability of the findings.
3. **Outcomes:** Key outcomes were extracted to assess the efficacy of the Ayurvedic formulations, including:
 - **Wound Healing Rates:** The speed and extent to which DFUs healed, measured by wound closure or reduction in wound size.
 - **Infection Control:** The effectiveness of the treatments in preventing or reducing infection, indicated by the need for antibiotics, the presence of infection markers, or clinical signs of infection.
 - **Pain Reduction:** Any documented decrease in pain associated with DFUs, as reported by the study participants or measured using validated pain scales.
 - **Other Healing Parameters:** These could include measurements like reduction in edema, improved tissue regeneration, or enhanced blood circulation to the affected area.
4. **Adverse Effects:** Any side effects or complications associated with the use of Aragvadhadi Gana and Aragvadhadi Ghrut were noted, including allergic reactions, irritation, or other dermatological issues from the topical application, or gastrointestinal issues from oral formulations.
5. **Follow-up Period:** Data on the duration of follow-up after treatment was also extracted to assess both short-term and long-term effects of the Ayurvedic treatments.

Analysis

The extracted studies were analyzed for their quality, risk of bias, and relevance to the research question. Each study was evaluated based on the following criteria:

1. **Study Quality:** The methodological rigor of each study was assessed. Randomized controlled trials (RCTs) were given higher weight in the analysis due to their stronger evidence in clinical research. Observational studies and case reports were also included but were given lower weight due to their inherent limitations, such as smaller sample sizes or lack of control groups.
2. **Risk of Bias:** The risk of bias in each study was assessed using established tools such as the Cochrane Risk of Bias tool for RCTs and the Newcastle-Ottawa Scale for observational studies. This included evaluating factors such as randomization methods, blinding, and the handling of missing data. Studies with high risk of bias or flawed designs were considered cautiously, as they might overestimate the treatment effect.
3. **Relevance:** The relevance of the study's outcomes to the review's objectives was critically examined. Studies that focused specifically on the use of Aragvadhadi Gana and Aragvadhadi Ghrut for DFUs, or those that reported data on the specific wound healing outcomes of interest, were prioritized.
4. **Statistical Significance:** Studies that reported statistical analyses (e.g., p-values, confidence intervals) were assessed for their statistical significance to understand the strength of the evidence. Where applicable, effect sizes or other measures of treatment efficacy were also considered to quantify the benefits of these Ayurvedic formulations.
5. **Consistency of Results:** Any inconsistencies or contradictions across studies were noted. If the findings of the studies varied significantly, potential reasons for this were considered, such as differences in study design, sample size, or treatment protocols.

Overall, the analysis aimed to provide a balanced view of the evidence supporting the use of Aragvadhadi Gana and Aragvadhadi Ghrut in the treatment of diabetic foot ulcers, highlighting both their potential benefits and limitations. The review aimed to synthesize the findings to provide a clearer understanding of how these Ayurvedic treatments compare with conventional therapies in managing DFUs and improving patient outcomes.

Observations and Results

Healing Rates

The healing rates associated with Aragvadhadi Gana and Aragvadhadi Ghrut in the treatment of diabetic foot ulcers (DFUs) were consistently positive across the studies reviewed. In the majority of clinical trials and observational studies, patients using these Ayurvedic formulations showed significant improvement in wound healing compared to baseline measurements. Specifically, Aragvadhadi Gana, when taken orally, demonstrated positive effects on wound healing by enhancing circulation, reducing inflammation, and promoting tissue regeneration. This oral formulation, which combines herbs like Aragvadha (*Cassia fistula*), Haridra (*Curcuma longa*), and Neem (*Azadirachta indica*), is thought to work by addressing systemic factors like immune function, circulation, and metabolic disturbances that contribute to poor wound healing in diabetic patients.

Aragvadhadi Ghrut, the medicated ghee applied topically, showed similar benefits. The formulation is traditionally believed to possess properties that help improve wound healing by promoting tissue regeneration and reducing inflammation at the site of the ulcer. The ghee base facilitates better absorption of the active herbs, ensuring that the therapeutic components directly reach the affected tissue. In several studies, the topical application of Aragvadhadi Ghrut was associated with accelerated wound closure and a reduction in the size of ulcers over the course of treatment. One key finding from the studies was that when Aragvadhadi Gana and Aragvadhadi Ghrut were used in combination with conventional wound care (such as debridement, advanced dressings, and antibiotics), the rate of wound healing was faster compared to conventional treatments alone. In particular, the combination treatment led to a decrease in the time required for wound closure, with some studies reporting that ulcers healed more than 30% faster compared to those treated with conventional therapies alone. This suggests that Ayurvedic formulations, when used as adjuncts to modern wound care, could enhance overall treatment outcomes for DFUs.

Furthermore, Aragvadhadi Gana and Aragvadhadi Ghrut not only promoted faster wound healing but also helped reduce the recurrence of DFUs. Recurrence of ulcers is a major challenge in managing DFUs, as they often reappear after healing due to underlying diabetic complications, such as poor blood circulation and nerve damage. Several studies reported that patients using these Ayurvedic formulations experienced fewer recurrences, possibly due to their holistic action on systemic and local wound healing mechanisms, which is often not addressed by conventional treatments alone.

Complications and Side Effects

Overall, the studies reviewed reported minimal side effects associated with the use of Aragvadhadi Gana and Aragvadhadi Ghrut. The topical application of Aragvadhadi Ghrut was generally well tolerated, with only a few instances of mild allergic reactions, such as skin irritation or rash at the application site. These reactions were typically transient and resolved after discontinuing the application or reducing the dosage. No major adverse events, such as severe allergic reactions, infections, or systemic side effects, were reported in any of the studies reviewed.

For Aragvadhadi Gana, the oral formulation was also well tolerated, with no significant gastrointestinal or systemic side effects observed. While Ayurvedic formulations like Aragvadhadi Gana are generally considered safe due to their natural composition, it is important to note that certain individuals may be sensitive to some of the herbs used in these formulations, particularly if they have known allergies to specific plants. However, such instances were rare in the studies reviewed, and the formulations were generally considered safe for the vast majority of patients.

It is also worth noting that Ayurvedic treatments like Aragvadhadi Gana and Aragvadhadi Ghrut are often considered gentler compared to synthetic drugs, with fewer and milder side effects. This could make them especially appealing for long-term use in chronic conditions like DFUs, where traditional treatments might pose a risk of prolonged antibiotic use, skin irritation from dressings, or complications from invasive procedures.

Comparison with Conventional Treatments

The comparison of Aragvadhadi Gana and Aragvadhadi Ghrut with conventional treatments such as antibiotics, advanced dressings, and debridement revealed that these Ayurvedic formulations were at least as effective, and in some cases, more effective than conventional treatments in managing DFUs. In several studies, Aragvadhadi Gana and Aragvadhadi Ghrut demonstrated superior results in controlling infection, reducing inflammation, and promoting tissue regeneration. For example, one study comparing the Ayurvedic formulations with silver sulfadiazine (a commonly used topical antibiotic) found that Aragvadhadi Ghrut not only accelerated wound healing but also showed better results in reducing infection markers and promoting healthy tissue growth.

The antimicrobial properties of Aragvadhadi Ghrut, derived from herbs like Neem, may have contributed to this enhanced infection control. Neem is widely known for its potent antibacterial and antifungal properties, which are particularly valuable in preventing secondary infections in diabetic foot ulcers, which are common and often lead to complications. Aragvadhadi Gana, as an oral formulation, also helped improve immune function, which could play a role in preventing infections and reducing the recurrence of DFUs.

In addition to infection control, Aragvadhadi Gana and Aragvadhadi Ghrut were found to be effective in reducing inflammation and promoting angiogenesis (the formation of new blood vessels). These are critical factors for wound healing, especially in diabetic patients who often suffer from poor circulation. By addressing the underlying mechanisms

of DFU development, such as impaired circulation and reduced immune function, these Ayurvedic formulations offered a holistic approach to treatment that was sometimes more comprehensive than conventional therapies.

However, it is important to note that the studies reviewed were often limited by small sample sizes and short follow-up periods. Larger, well-controlled studies with longer follow-up durations are needed to establish more definitive evidence of the long-term efficacy of Aragvadhadi Gana and Aragvadhadi Ghrut. Additionally, while these Ayurvedic treatments demonstrated comparable or superior results in some areas, conventional treatments remain critical, especially in more severe cases of DFUs, where surgical intervention may be required. Therefore, Aragvadhadi Gana and Aragvadhadi Ghrut should be considered as complementary therapies that can work alongside conventional methods to improve overall patient outcomes.

Discussion

Comparison with Current Literature

The findings from the studies reviewed in this article are in alignment with existing literature suggesting that Ayurvedic formulations, such as Aragvadhadi Gana and Aragvadhadi Ghrut, offer promising benefits for the treatment of diabetic foot ulcers (DFUs). Research has consistently demonstrated that traditional herbal remedies can play a significant role in wound healing by addressing the underlying mechanisms that contribute to delayed healing in diabetic patients. The Ayurvedic formulations reviewed in this study appear to offer complementary benefits to conventional treatments, addressing several common limitations associated with modern wound care.

Conventional treatments for DFUs, such as antibiotics, advanced dressings, and debridement, are effective at controlling infection and promoting healing to some extent. However, these approaches often have limitations in terms of recurrence, delayed healing, and managing the underlying issues like poor circulation and immune dysfunction in diabetic patients. In comparison, Aragvadhadi Gana and Aragvadhadi Ghrut target these underlying issues through a holistic approach, enhancing wound healing by improving circulation, reducing inflammation, and promoting tissue regeneration. This aligns with existing studies that have shown the potential for Ayurvedic treatments to complement modern therapies by accelerating wound closure and reducing recurrence rates. Additionally, the use of natural ingredients with antimicrobial, anti-inflammatory, and immune-boosting properties in these formulations presents an opportunity to reduce the reliance on synthetic drugs and minimize side effects.

Furthermore, Aragvadhadi Gana and Aragvadhadi Ghrut have demonstrated promising outcomes in studies conducted in India and other regions where Ayurvedic medicine is more widely practiced. These findings mirror the observations of previous studies, indicating that Ayurvedic treatments can be both effective and safe in the management of chronic wounds like DFUs. Overall, this review contributes to a growing body of evidence supporting the role of Ayurvedic formulations in modern wound care, especially in populations with limited access to expensive or advanced medical treatments.

Mechanisms of Action

The therapeutic efficacy of Aragvadhadi Gana and Aragvadhadi Ghrut is believed to arise from their multifaceted mechanisms of action, each of which contributes to the healing process of diabetic foot ulcers. Several key factors play a role in the wound-healing process for DFUs, and these Ayurvedic formulations appear to address these factors in a holistic manner.

1. **Reduction of Inflammation:** One of the primary mechanisms by which Aragvadhadi Gana and Aragvadhadi Ghrut promote healing is through their anti-inflammatory effects. Chronic inflammation is a common feature in DFUs, which delays the healing process and impairs tissue regeneration. Herbs like Haridra (turmeric) and Neem (*Azadirachta indica*) are known for their potent anti-inflammatory properties. Haridra, in particular, contains curcumin, which has been extensively studied for its ability to reduce pro-inflammatory cytokines, modulate immune responses, and accelerate wound healing. Similarly, Neem has long been used in Ayurvedic medicine for its ability to balance the immune system and reduce local inflammation, both of which are critical for wound healing in diabetic ulcers.
2. **Promotion of Collagen Synthesis:** Collagen is an essential protein in wound healing, contributing to tissue strength and structure. Ayurvedic formulations like Aragvadhadi Gana and Aragvadhadi Ghrut are thought to promote collagen synthesis by enhancing the production of fibroblasts (cells responsible for collagen production). This is particularly important in DFUs, where impaired collagen synthesis often results in slow healing and poor tissue regeneration. The synergistic effects of the active herbs in these formulations stimulate the production of collagen and other extracellular matrix proteins, which support wound closure and tissue regeneration.
3. **Enhanced Circulation:** Poor blood flow to the affected areas, due to diabetic complications like peripheral arterial disease (PAD) and neuropathy, is another factor that hampers wound healing in DFUs. Both Aragvadhadi Gana and Aragvadhadi Ghrut are believed to improve circulation to the wound site, ensuring that oxygen, nutrients, and immune cells are efficiently delivered to the ulcer. This effect is thought to be mediated by the vasodilatory properties of some of the herbs used in these formulations, including Aragvadha (*Cassia*

fistula) and Neem. By enhancing local blood flow, these treatments support the body's natural healing processes, reducing the risk of infection and promoting faster tissue repair.

4. **Antimicrobial Effects:** Infections are a major concern in diabetic foot ulcers, as diabetic patients often have compromised immune systems. The antimicrobial properties of the herbs in Aragvadhadi Gana and Aragvadhadi Ghrut help prevent or control infections at the wound site. Neem, known for its strong antimicrobial activity, helps reduce the bacterial load in the wound, while Haridra has been shown to exhibit antibacterial, antifungal, and antiviral properties. These antimicrobial actions are essential in preventing secondary infections, which can exacerbate the ulcer and delay healing.

Patient Outcomes and Efficacy

In terms of patient-reported outcomes, the use of Aragvadhadi Gana and Aragvadhadi Ghrut has shown significant improvements in several key areas, particularly in terms of pain reduction, quality of life, and overall satisfaction with treatment. Many patients reported a decrease in pain associated with their foot ulcers, which is a crucial factor in enhancing the quality of life for individuals suffering from DFUs. This reduction in pain may be attributed to the anti-inflammatory and analgesic properties of the active herbs in these formulations.

Moreover, patients who used these Ayurvedic formulations reported faster healing times and reduced recurrence of DFUs, which is particularly encouraging given the high recurrence rate of DFUs in diabetic patients. The improvements in wound healing and recurrence were often more pronounced when Aragvadhadi Gana and Aragvadhadi Ghrut were used as adjuncts to conventional treatments. The holistic nature of these formulations—addressing both local and systemic factors involved in wound healing—may explain these positive outcomes.

Additionally, patient satisfaction was high in studies where Aragvadhadi Gana and Aragvadhadi Ghrut were used, with many participants expressing a preference for these natural treatments due to their lower incidence of side effects compared to synthetic drugs. This reflects a broader trend in healthcare, where patients are increasingly seeking more natural and integrative treatment options that are less likely to cause adverse reactions or contribute to antibiotic resistance.

Limitations of the Studies Reviewed

Despite the promising results, there are several limitations to the studies reviewed. One of the primary limitations is the relatively small sample sizes of the studies included. Many of the trials and observational studies had fewer than 50 participants, which limits the generalizability of the findings. Smaller sample sizes also reduce the statistical power of the studies, making it more difficult to detect true treatment effects.

Another limitation is the short duration of follow-up in most studies. While many studies reported improvements in wound healing and patient outcomes, the long-term effects of Aragvadhadi Gana and Aragvadhadi Ghrut remain unclear. Longer follow-up periods would provide valuable information on the recurrence rates of DFUs and the sustainability of the therapeutic benefits.

Additionally, some of the studies had potential biases in study design, such as a lack of blinding or randomization, which could influence the results. The heterogeneity of the study designs and the varying quality of reporting also make it challenging to draw definitive conclusions.

Future Research Directions

To address these limitations, future research should focus on conducting larger, well-designed, randomized controlled trials (RCTs) with longer follow-up periods. Larger sample sizes would provide more robust evidence of the efficacy and safety of Aragvadhadi Gana and Aragvadhadi Ghrut in treating DFUs. Furthermore, studies with longer follow-up periods would help determine whether the improvements in wound healing and reduction in recurrence are sustained over time.

In addition, future studies should focus on investigating the molecular mechanisms underlying the effects of these Ayurvedic formulations. Research exploring the specific pathways through which the herbs in Aragvadhadi Gana and Aragvadhadi Ghrut influence wound healing—such as their effects on collagen synthesis, angiogenesis, and immune modulation—would provide a deeper understanding of their therapeutic actions.

Finally, future research should explore the potential for integrating Aragvadhadi Gana and Aragvadhadi Ghrut with other advanced wound care treatments, such as bioengineered dressings or stem cell therapy, to optimize healing outcomes for diabetic foot ulcers.

Conclusion

In conclusion, Aragvadhadi Gana and Aragvadhadi Ghrut have demonstrated significant promise as therapeutic options in the management of diabetic foot ulcers (DFUs). Both formulations offer a holistic approach to wound healing, addressing multiple critical aspects of the healing process, such as infection control, reduction of inflammation, and promotion of tissue regeneration. The antimicrobial properties of these Ayurvedic formulations, particularly from herbs like Neem and Haridra, provide a natural means of managing infection, a common and serious complication in diabetic foot ulcers. Additionally, the anti-inflammatory effects help reduce the chronic inflammation that impedes the healing

of DFUs, and the regenerative properties of these formulations support the restoration of healthy tissue at the wound site.

The findings from the studies reviewed indicate that Aragvadhadi Gana and Aragvadhadi Ghrut can be particularly beneficial in cases where conventional treatments have shown limited effectiveness or where access to advanced modern therapies is restricted. These Ayurvedic formulations appear to offer a safe and effective complementary treatment, providing relief and promoting healing in a more natural and accessible manner, especially in resource-limited settings where synthetic drugs and advanced dressings might not be readily available.

However, while the outcomes from the studies reviewed are promising, it is important to acknowledge the limitations of the current body of research. Many of the studies were characterized by small sample sizes, short follow-up durations, and the absence of robust randomized controlled trials (RCTs), which are critical for confirming the long-term efficacy and safety of these treatments. Larger, well-conducted RCTs with extended follow-up periods are essential to establish a clearer understanding of the sustained benefits and safety of Aragvadhadi Gana and Aragvadhadi Ghrut in DFU management. Furthermore, exploring the molecular and cellular mechanisms underlying the therapeutic actions of these formulations would provide deeper insights into how they promote wound healing, which could further validate their role in modern wound care.

Despite these limitations, Aragvadhadi Gana and Aragvadhadi Ghrut present a valuable and potentially cost-effective alternative to conventional treatments. The integration of Ayurvedic formulations into conventional wound care practices could enhance overall treatment outcomes, particularly for patients who seek alternative or complementary therapies. In clinical settings, these Ayurvedic formulations could be used as adjuncts to conventional methods, offering a more comprehensive approach that addresses both the systemic and local factors contributing to delayed wound healing in diabetic foot ulcers.

Moving forward, future research should explore the potential synergistic effects of combining Aragvadhadi Gana and Aragvadhadi Ghrut with conventional therapies, including advanced wound dressings and antibiotics. Assessing the impact of this integrative approach on patient outcomes such as pain reduction, quality of life, and recurrence rates could provide valuable evidence to support the widespread use of these Ayurvedic formulations.

Healthcare providers should consider incorporating Aragvadhadi Gana and Aragvadhadi Ghrut into their treatment protocols for DFUs, particularly for patients looking for holistic, natural treatments. By embracing an integrative approach that combines both traditional and modern medicine, healthcare practitioners can offer a more patient-centered, accessible, and effective approach to wound care, improving patient outcomes and reducing the burden of diabetic foot ulcers in diabetic patients.

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