Available online at www.jobpcr.com

ISSN-2394:3076
CODEN(USA) : JBPCBK

Journal of Biological Pharmaceutical And Chemical Research , 2020, 7(2): 1-26

(http://www.jobpcr.com/arhcive.php)

METHOD OF TREATMENT OF BURNS CAUSED BY ACID AND BOILED WOUNDS: A NATURAL PERSPECTIVE

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ABSTRACT

One of the most severe injuries is a burn. Burn wounds are classified according to the depth and severity of the burn. One of the most common and challenging issues burn patients face is the spread of infection, which can impede the healing process. Traditional treatments for burn wounds utilizing natural resources are one of the best options since they significantly reduce the risk of infection. To put it another way, natural resources are cost-effective and free of additional issues. Many cutting-edge treatments for burn wounds are available, but many can have serious side effects and toxicities. Therefore, there is a need for natural solutions to limit the risk of subsequent issues. Traditional and herbal therapies for the treatment of burns caused by acid attacks and domestic abuse with boiling water have been highlighted in this review because of the growing public concern about women's safety in our country. The herbal resource is the focus of this article. In an effort to better understand acid and boiling burn wounds' biology and management, here is a review and exploration of these wounds. To better manage the above-mentioned situations, further scientific research on the natural resources indicated will be advantageous.

Key words: acid burn, boiled burn, wound, infection, traditional remedy.

INTRODUCTION

Burns are among the most well-known in terms of physical and mental trauma. Burns damage the sensitive tissues in the body. Burning-related alterations in the skin's sensitive tissues long-term affect the healing process [1, 2]. Burn wounds are complicated to treat. Many patients have died while undergoing therapy because of respiratory arrest and excruciating discomfort [3, 4]. Alternating inflammatory responses have been shown to hasten the healing of burn scars [5]. As a result, burn wounds are one of the most painful illnesses that affect the patient's health and impose a financial burden [6]. Flavonoids, alkaloids, saponins, and phenolic chemicals are the most potent stimulators of wound contraction in a wide variety of species [7]. A large amount of the burn is covered by an acid burn wound and a boiling burn wound. Domestic violence or a case of

retribution against women is sometimes referred to as an acid burn assault, but it is not exclusive to women. Assaults on male victims are often motivated by a disagreement over property, criminality, and violence [8]. As a result of the acid attack, a person's health and well-being are adversely affected. It is becoming increasingly difficult for them to accept society and their own existence [9]. Boiling water is the primary source of thermal burns. In extreme circumstances, protein and immunoglobulin are lost from the body [10]. Depending on the severity of the burn, the patient should be treated and handled with extreme caution. Scar-free healing and the management of infection should be the treatment goals. According to a recent survey (Table 1), boiling wounds are more likely to be caused by domestic abuse or accidents than any other cause.

On the other hand, acid attacks on women and girls are motivated by a desire to harm their appearance (Table 2). Though in all cases of burns, the intensity and pain are great along with infections, the burns due to acid attack and boiled burn wound are taken into mind for availing their suitable natural quick therapy to reduce secondary problems.

Table: 1 Accidental boiled burn cause and category

Category	**Cause**
Children (Pediatric)	A kid's disability might cause their abuse; hostility, an undesired child, or domestic violence can also lead to their abuse, and sometimes it is an accident. [12].
Adult (Women)	Domestic violence is common among women who work in the kitchen. [13].
Adult (Men)	Unintentional, accidental, and sometimes suicidal [14].
Elderly above 50 years	As a result of marital violence and ready access to a flame or boiling water, [15].

Table: 2 Acid attacks on women (target face)

Country	**Reason for acid attack**	**Target of attack**
India	Violence and molestation have led to societal stratification and a shift in gender roles and dowry.	Face to destroy the beauty
Bangladesh	Theft, kidnapping, and indecent assault are all forms of sexual harassment.	Face
Cambodia	Women's trafficking and domestic abuse are both on the rise.	Face
Sri Lanka	They refuse to accept the proposal because of their religious beliefs and attire.	Skin and face [16].

Pathophysiology of burn

Pro-inflammatory cytokines are seen in higher concentrations in the blood after a burn wound has healed. In the aftermath of a burn wound, leukocytes are essential participants in producing tumor necrosis factor (TNF-) and interleukin-I (IL-I). Both cytokines cause inflammation, fever, and a general catabolic condition. Endothelial cells and macrophages control the production of prostaglandins, platelet-activating factor, and interleukin-6 (IL-6). T-cells are activated during the acute phase. Another pro-inflammatory cytokine following burn injury is natural killer (NK) and T-helper type-I (Th-I) cell-produced gamma interferon [17].

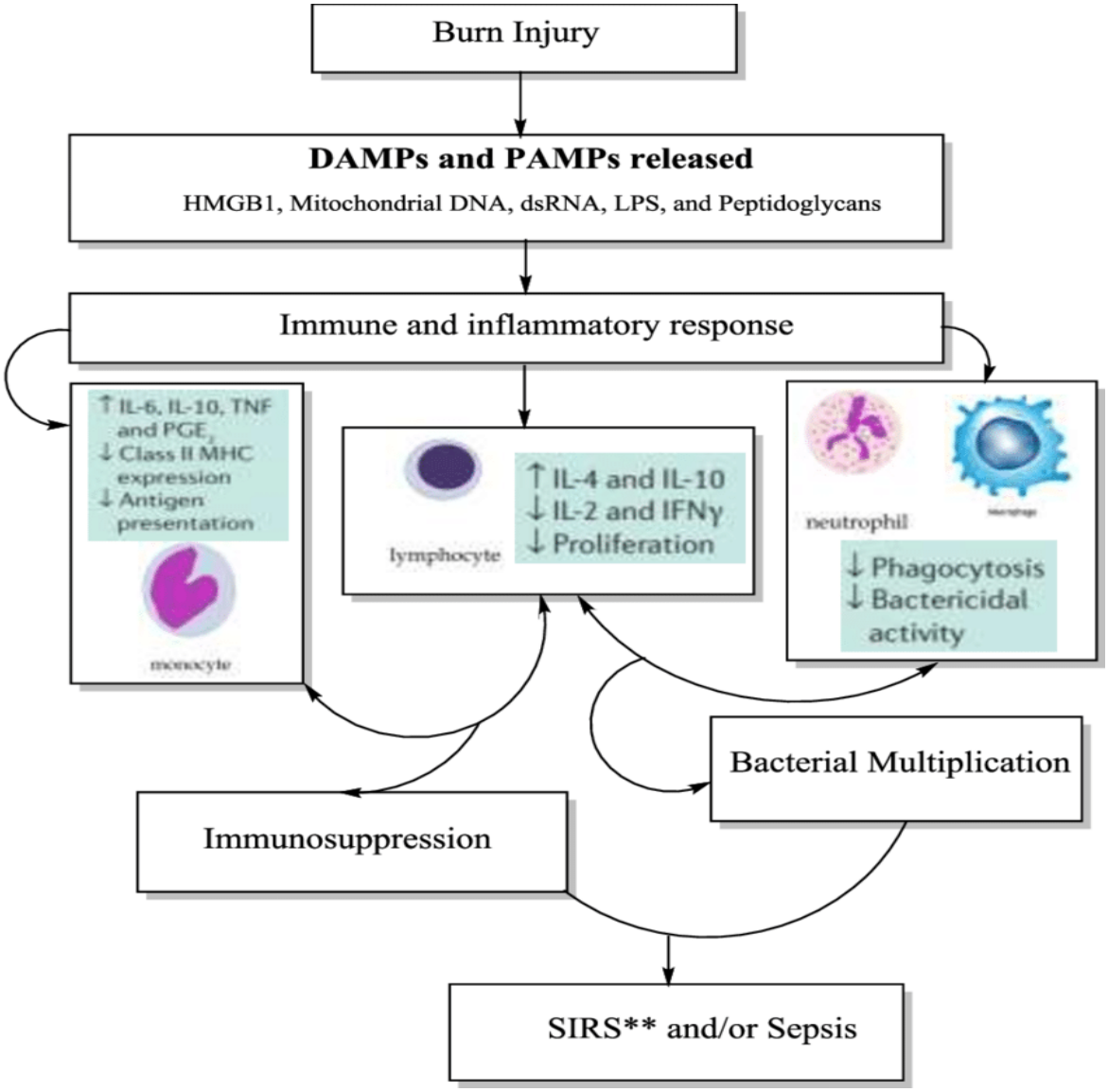


Fig: 1 pathophysiology of burn

An example of this is shown in Fig 1. Mitochondrial D.N.A. and dsRNA and pathogen-associated molecular patterns (PAMPs) like lipopolysaccharides and peptidoglycan are produced during a burn injury, which causes the production of endogenous damage-associated molecular patterns (DAMPs). Increased muscle protein breakdown, insulin resistance, and increased heart stress are

just a few of the metabolic alterations brought on by this capillary leakage, inflammatory reaction, and metabolic abnormalities. In contrast, an inflammatory response includes monocytes (increasing IL-6, IL-10, TNF, P.G.E., class II MHC expression, and antigen expression) and T-helper cells (increasing IL-4, I.F.N. gamma, and proliferation) results in immunosuppression. Bacterial proliferation is facilitated by macrophages and neutrophils (which decrease phagocytosis and decrease bactericidal). SIRS is an inflammatory state that affects the entire body, leading to multiple organ failure and eventually death [18] as a result of these occurrences.

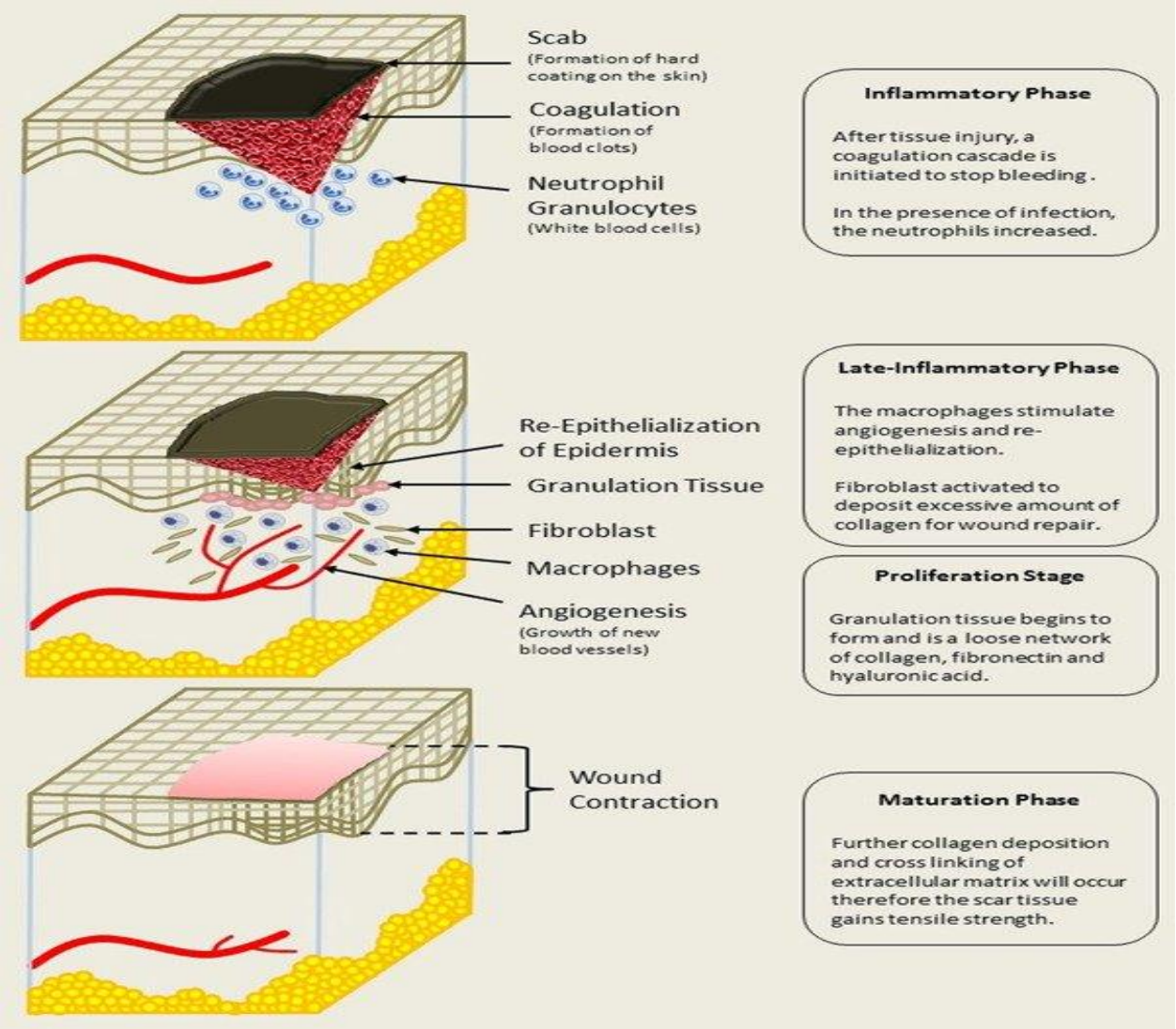


Fig: 2 Stages of natural wound healing

Stages of Wound healing :

Hemostasis:

In this stage, which occurs immediately following burn injury, keratinocytes and platelets are activated, aggregation is increased, and growth factors such as platelet-derived growth factor (PDGF), epidermal growth factor (EGF), and transforming growth factor-beta (T.G.F.) are released by the keratinocytes, platelets, and fibroblasts. As a temporary structure for the later stages of

healing and an initiator of inflammation, this creates a fibrin clot that accumulates in the burned area [19].

Inflammation: The inflammation stage begins within 24 hours of the injury and lasts for a few days, depending on the severity of the burn. A variety of growth factors, including insulin-like growth factor (IGF), transforming growth factor-beta (T.G.F.), and vascular endothelial growth factor (VEGF), are produced by macrophages, neutrophils, and eosinophils, which aid in the elimination of pathogens [20].

Proliferation: Proliferation is the term used to describe the process of fibroblast and keratinocyte recruitment and activation at the wound site. Epithelialization and angiogenesis rely on keratinocytes, which are involved in both processes. VEGF, H.G.F., and FGF are all growth hormones that stimulate the growth of endothelial cells, which in turn triggers angiogenesis, the formation of new blood vessels (FGF). The remaining fibroblasts are transformed into myofibroblasts and employed to form an extracellular matrix [21].

Remodeling: Remodeling is the last step in the natural healing process of a burn wound. Growth factors aid in the regeneration of the granulation tissue in this stage of E.M.C. remodeling. TIMPs and M.M.P.s contribute to tensile strength by inhibiting metalloproteinases in the tissue. Elements such as inflammatory cascade activation, injury severity, and a patient's nutrition are all critical for burn wound healing. Inflammatory mediators and a rise in nitric oxide could be blamed for the capillary leakage [22].

Burn Wound Sepsis: It is a series of disastrous and deadly complications for the patient who has been burned [23]. Almost all burns become contaminated by bacteria, pollution, and dust, which prolongs healing time and complicates the burn's state to the point of death [24]. The germs penetrate deeper into the skin because of the burn's depth and the surrounding environment. This results in a more severe infection. Burn wound infection, urinary tract infection, and bloodstream infection are the most common kinds of nosocomial infection in burn patients [25].

Classification of the burn wound

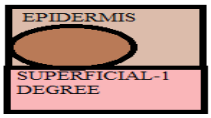
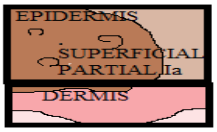
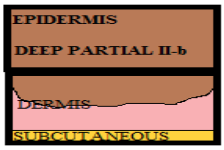
Burns are classified into many categories based on the type of organism that caused the injury, the severity of the wound, and the response of the victim's tissue. The article's primary focus is on classifying burns based on the source (Table 3). There are five types of burns. These burns are classified into four categories based on severity and depth. [27]

Table 3: Classification of burns depending on causes

Type of burn	Cause of burn	Description	Mechanism
Thermal burn	A variety of methods can cause scalds and burns.	Third- and second-degree burns can result from thermal damage.	The skin's principal sensory fiber subclasses are stimulated by the heat generated [28, 29].
Electrical burn	High and low voltages in contact	In and out points are formed by the passage of electricity through the body.	Skin is damaged due to the reactive chemical reaction that occurs when voltage is applied.[30]

Flash burn	With welding and any sort of ultraviolet (U.V.U.V.) light.	Expose the body to an electrified electrical conductor or circuit component at a distance of several meters.	Arc current forming from a high voltage source[31]
Radiation burn	By X-ray, U.V.U.V. ray, or radiation.	Radiofrequency damage skin.	Cellular D.N.A. is the primary target of radiation.[32]
Chemical burn	By acid, alkali, and other explosive chemicals.	Chemical burns are mainly full-thickness burns that also cause coagulative necrosis.	Response reaction between skin segment and causative agent [33, 34].

Table 4: Classification of burns depending on severity and depth

Classification based on severity and depth	**Description**	**Diagrammatic representation**
Superficial I degree	The epidermis, the outermost layer of the skin, is the only part of the affected body. [35].	
Superficial partial II a degree	Include both the epidermis and the dermis layers of the skin. Blisters form on the skin's surface when pressure is applied. [36].	
Deep partial II b degree	It includes the reticular dermis, which is the lowermost layer of the dermis. All appendages have disappeared, and the skin appears dry and white. [37, 38].	
Deep III degree	A whole skin thickness is included. Leathery, dry, white, or red skin with thrombosed veins results from this condition [39].	

Challenges and advances in burn wound healing

- Skin grafting, skin substitutes, wound dressings, and negative pressure is clinical practices in burn injuries.
- Infection, discomfort, and scarring are some of the difficulties burn victims face.
- Skin tissue engineering, new materials, and cutting-edge technology have made significant progress in burn wound healing in recent years. [40].

1. Clinical practices in burn injury

a) **Skin grafting**: It is one of the essential techniques used by dermatologists to undertake sensitive tissue reconstruction. The free skin is transplanted using this method where skin grating needs to be done on the body. The results of this approach are used to help treat burn burns by reconstructing the tissue. [41].
b) **Skin substituents**: Restoring lost tissue integrity, avoiding scarring, and repairing damaged tissue are key functions of a biopolymer called a skin substitute. [42].
c) **Wound dressing**: Several factors contribute to wound healing, including the environment in which it takes place. Thanks to advances in technology, it is now possible to treat diverse wounds, such as burn wounds, by focusing on different aspects of the healing process. [43].
d) **Negative pressure wound therapy (N**.P.W.T.): The use of N.P.W.T. in treating burn wounds is also supported by scientific research. N.P.W.T. increases the rate at which tissue granulation occurs. N.P.W.T. also helps to improve contamination-related infections. [44].

2. Challenges faced by burn injury

a) **Infection**: Bacteria penetrate deeper into the skin and produce serious infections due to the depth and severity of the burns [45]. When dealing with burn wound infections, it is essential to treat them with extra care because they can take longer and require more work than other infections [46]. Microorganisms have been shown to colonize, which may impact the patient's health in the future [47].
b) **Pain:** Burns inflict excruciating pain. Patients may acquire stress-related issues as a result of their chronic pain. Burn injury pain has been documented as one of burn victims' most critical clinical issues. Burn pain treatment is insufficient to provide complete pain relief [48].
c) **Scarring**: After a burn injury has healed, researchers have found that scars remain on the burned area. Using traditional methods to repair scars is the most effective way. Traditional treatments for burn scars can take some time to show results, but several options are available. Treatments should include massage therapy, moisturizer, and lotion to expedite scar healing. [49].

3**. Advances seen during burn wound healing**

a) **Skin tissue engineering:** In skin tissue culture, the goal is to induce new skin growth by cell culture and polymer chemistry. This treatment is frequently employed in burn wound healing, whether the burn is acidic or thermal (boiling water). [50].
b) **Innovative material and advanced technologies:** Many new and advanced technologies are now accessible to replace traditional procedures, including allograft, keratinocyte culture, xenograft, and keratinocyte culture [51, 52].

Natural remedy for burn due to acid and boiled wounds

Some of our ancestors' knowledge about the therapeutic properties of plants and animals was passed down through the generations through oral tradition [53]. Several studies have shown beneficial outcomes when traditional remedies treat burns [54]. Additionally, traditional treatment helps to alleviate the financial load on patients. There is more spontaneity in using natural remedies than in using cutting-edge medical technology. [55].

Carica papaya **(latex)**: The latex from the Carica papaya is excellent for treating burns. By desloughing the tissue, the antibacterial properties of chymopapain and papains in latex aid in

preventing infection [56]. Non-healing burn wounds are caused mainly by the sloughy skin tissue that develops after the normal skin tissue dies from the burn. Burn wound therapy includes preventing the spread of infection and removing eschar. In addition to softening the damaged skin, chymopapain and papain also can break down and digest dead skin cells. Papaya latex has been demonstrated to help offer less painful, scar-free, and cleaner burn treatment [57] from several studies.

Honey (*Apis*): As a moisturizing agent and antibacterial, honey is an excellent choice for treating minor burns. Honey's levulose and fructose aid in tissue regeneration [58]. Using wound swabs, researchers found that honey treatment significantly reduced infection rates and early tissue granulation. Doctors are now using honey as an alternative treatment for burn injuries. Honey is beneficial in the treatment of superficial and partial-thickness burns. [59].

***Arnebia euchroma* (roots)**: There are no Arnebia plants in Iran. They have antibacterial and anti-inflammatory properties, which help treat burns. Arnebia euchroma roots and goat lipid are used to treat burns. There are more fibroblasts with inflamed cells and more well-organized collagen bands. Arnebia euchroma comprises arnebin-1 and shikonin, the two primary components. Reduces the width of the wound's gap length facilitates the growth and creation of thick granulation tissue and the regeneration of the wound epithelium. Oxidation converts the shikonin derivative into the shikonin semiquinone radical, vital in burn wound healing [60].

***Malva sylvestris* (flowers):** This plant is native to Iran. Anti-inflammatory, antimicrobial, and anti-tumor properties of the plant are used to treat burns. Many people believe that applying cold cream to Malva sylvestris flowers can help heal burns. Malvone A: 2-methyl-3methoxy-5, 6-dihydroxy-1, four naphthoquinone is some of the phytochemical components of Malva sylvestris that may be responsible for the antibacterial action of Malva sylvestris. This shows that burn wound healing has been used in this way for centuries. [61].

Combretum: A vast and widespread genus is Combretum. Antifungal, antibacterial, anti-inflammatory, cytotoxicity against tumor cell lines, antimalarial [62], antioxidant, and anti-venom [62] are some of the traditional biological medicinal actions of the 200 to 250 species in this group. Senegalese native Combretum glutinosum is the source of this plant's name. Traditional Senegalese medicine relies on the bark of glutinosum trunks to treat burn wounds. Tanning and a triterpenoid component are found in the bark's aqueous extract, making it both soothing and anti-inflammatory on the skin. Mali-based plant Combretum mircanthum. In the treatment of burns, the root extract is employed. According to research, there are four additional species of Combretum that have antibacterial activity without causing any adverse effects and are therefore effective in the healing of burn wounds. There are a total of four species: Combretum nelson, Combretum albopuntactum, Combretum imberbe, and Terminalia sericea [65].

***Capsicum annuum L.* (leaves)**: This plant originates from Ethiopia. The extraction treated the burn wound of the leaves. In addition to being nutritious, Capsicum annum has therapeutic value. To heal burn wounds, it is one of the traditional herbs that has been widely explored for its anti-inflammatory and antioxidant qualities. [66].Capsaicinoids and their constituents, including capsaicin, cis-capsaicin, dihydrocapsaicin, and capsiate, have antibacterial and anti-inflammatory properties, decreasing pain and inhibiting inflammation. [67].

***Allium Sativa* (stem)**: Known as garlic in Asia, the plant is endemic to Iran's northeast and central regions. After the decoction procedure, the stem is used to clean the burn area and treat it with sesame oil [68]. As a result of acid or boiling water burns in particular. Based on research, it has been found that crushed garlic cloves used orally to control burn wound infection in patients of various burn sizes can effectively prevent pseudomonas aeruginosa infection. Research on garlic's antibacterial and antifungal properties began in the 19th century [69]. Garlic extract has been proven to be as efficient as 1 percent silver sulfadiazine in lowering the number of bacteria in burn wounds after a 10% (v/v) garlic extract was applied to the wounds of mice. The lipid composition of cell membranes was altered due to garlic extract's antibacterial properties. [70].

***Guiera senegalensis* (leaves)**: Tropical Africa is the plant's natural habitat. After crushing the leaves, the paste is put to the burn. Antimicrobial action (naphthalene ketone derivative) of the leaves against gram-positive and gram-negative bacteria helps prevent and cure burn infections. It also has antifungal properties because of the presence of guieranone in the formula. [71, 73].

***Lawsonia inermis* (leaves**): Henna (Lawsonia inermis) plant is native to Australia, Asia, and Northern Africa. [73] The dried leaves are ground into a paste smeared on a burn as an antibacterial agent. Aspergillus niger, Candida Albicans, and aeruginosa are bacteria that can cause infection at a burn site [74]. The use of henna can help prevent and reduce this. Antimicrobial properties of the plant are attributed to the presence of 2-hydroxynaphthoquinones (lawsone), a prominent component of the plant's phytochemical ingredients (tannic acid, mannite, gallic acid). A study has found that henna-loaded gelatin oxidized starch mat dressing can be utilized to treat burns. Burn wound dressings with henna-loaded gelatin revealed low inflammation, reduced macrophages, antibacterial and antifungal properties at the burn site [75].

***Aloe vera* (leaves)**: Southeastern Europe is the natural habitat of this plant. Aloe vera has been used for burns in the past, but there are no clinical studies to back it up [76]. Aloe vera can be used as an epithelial stimulant to speed up the healing process. Antiseptic, anti-inflammatory, antifungal, and antibacterial properties in the aloe vera leaves, including lupeol and salicylic acid [77]. Since the aloe plant contains a glycoprotein, a review was undertaken to see if it might be used for burn therapy, based on the findings of this review [78]. This shows that aloe leaf can speed up the healing process and the rate of epithelization [79].

***Solanum tuberosum* (peel)**: The potato plant is indigenous to the United States [80]. Potato peels used as dressing on burns have been shown in numerous trials to cause burns [81]. Easy application, non-adhesion to the wound, antibacterial and non-allergenic, inexpensive, and readily available are the ideal characteristics of an ideal dressing [82]. One solution with ideal wound treatment qualities is a boiled potato dressing. The epithelium can regenerate and ease the pain when cooked potato peel is used as a dressing. As well as providing a moist environment, it aids in the dehydration of the burn wound and the speedy recovery of the burn [83].

Laponite: Synthetic clay is what it is. Because of its antibacterial qualities, laponite can be used to treat burns. Laponite has been produced and manufactured as hydrogel, sponges, and films to treat burns. According to a review, in-vitro tests on burn wound dressings have shown laponite and mafedine to be effective. Laponite's interlayer gaps can accept the mafedine molecule because of its strong capacity for interlayer ion exchange. This aids in the faster healing of burn wounds and preventing the spread of infection. [84].

According to a literature review, cow urine: In Nepal, cow urine is extensively utilized as a therapeutic agent to treat burn wound inflammation. 2,2diphenyl-1-picrylhydrazyl free radical was used to measure antioxidant activity, and agar disc diffusion was used to measure antibacterial activity in cow pee (D.D.P.H.). It has been found that as altitude increases, the antioxidant activity of cow pee increases significantly [85].

One of the most commonly utilized home treatments for burn wounds in rural communities is cow dung many harmful microbes, including E.coli, staphylococcus aureus, and bacillus subtilis. In the wound healing process, proteolytic enzymes such as collagenases, elastases, and matrix-metalloproteinases (M.M.P.s) break down scar tissue. To eliminate non-viable tissue from wounds, commercial debriding ointments commonly contain these enzymes. The presence of such proteases may play a role in the efficacy or presumed efficacy of cow dung for burns treatment. [86].

According to a survey, Gentian violet pain: Total body surface area burns ranged from 15% to 50% in 400 patients admitted to the burn ward. All patients in this group received conventional medical treatment. Local gentian violet paint users make up Group II. Local treatment of gentian violet paint cured the burn lesion after six to eight weeks without necessitating skin transplantation or severe infection. Burn wound treatment can be made more cost-effective by using this paint. [87].

Electrolyzed oxidized water irrigation: According to a study, electrolyzed oxidized water (E.O.W.) was used to treat a rat burn wound model infected with Pseudomonas aeruginosa because of the bactericide activity E.O.W. Physiologic saline irrigation, E.O.W. irrigation, or no irrigation was used on rats in groups –I, II, and III. Survival rates, endotoxin levels, and blood cultures were measured. Group-III (E.O.W. irrigation) had a much higher survival rate than the other two groups. Electrolyzed oxidized water irrigation, according to this study, aids in the prevention of burn wound sepsi**s.** [88].

CONCLUSION

Acid and boiled wounds pose a social hazard. Hence, the pathophysiology and natural healing of burns caused by acid and boiling water were examined in detail in this review. It is also linked to how bioactive molecules from specific natural resources regulate burns. The current study stresses the use of traditional remedies to treat burn injuries of any kind. Moreover, it was found that many traditional remedies cure acid and boiled burns almost by the exact mechanism, that is, by inhibiting the bacterial or many other types of infection and increasing re-growth of tissue or enhancing the rate of epithelialization. On the other hand, the study has a positive outlook on the use of herbal treatments to eradicate burn scars that persist even after therapy. There is a wide range of novel and cutting-edge treatments for burns available today.

On the other hand, traditional cures are more cost-effective since they do not require new technologies and do not have as many unintended side effects. This review article will benefit several scientific studies on burn injuries by incorporating cutting-edge technology as a research emphasis in creating better medication for the management of acid and burn wounds. As a result of its easy availability, burn management in first aid therapy will benefit socioeconomically.

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