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Literature review on selected *Ayurvedic* formula in the management of wound healing

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Abstract

Wounds have been widespread issues since ancient times. Although the restoration of tissue is a normal reaction to any form of injury, the healing of an open wound is delayed by bacterial contamination. In the medical science of Ayurveda, there are numerous pearls that can be used to cure wounds without any complications. Our *Āchāryās* (teachers) categorized the medications related to *Vrana Shōdhana* (wound cleaning) and *Vrana Rōpana* (wound healing) and provided a general description of the treatment concepts of wound management. Six plants with various therapeutic properties, cow ghee, and rock salt make up a particular Ayurveda formula. In order to manage wound healing, this study reviewed a few *Ayurvedic* formulas that are mentioned in the *Bhāvaprakāsha* (classical text) based on their pharmacological and pharmacodynamics capabilities. The main goal of this investigation is to examine how the chemicals in this recipe affect wound healing. Information about wound was acquired from *Ayurvedic* scriptures, contemporary texts, and earlier research studies (from primary and secondary sources). Afterwards a survey of the literature was done on those six herbs. Also, these selected herbs were examined for their *Pancha Padārtha* (5 elements of the herb) and pharmacological qualities. Due to the fact that the chosen formula was primarily made up of *Kapha*, *Pitta* and *Vāta Shamana* (pacify humors of body) it was noted that the *Ayurvedic* pharmacodynamics qualities and actions (karmas) for wound healing were found. As a result, the effectiveness of the chosen *Ayurvedic* formula in managing wound healing can be demonstrated.

Keywords: *Vrana*; *Vrana Rōpana*; *Vrana Shōdhana*; Wound

1. Introduction

The main factor causing physical limitations is wounds. Different sorts of wounds and how to treat them have been thoroughly defined by modern science. A succession of events unfold in an ordered fashion while the wound heals. If the healing does not proceed in the regular step-by-step fashion, a chronic wound may form ^[1]. Even in the modern era, healing a wound is a difficult effort for surgeons. Our bodies use healing as a defense mechanism against illness. Numerous antibacterial compositions are accessible in current science, each with its own drawbacks. The process of a wound healing is complicated and varies from patient to patient. When the wounds do not get better after four weeks or do not heal in eight weeks, they are said to be non-healing. The fundamental causes of slow healing are impaired tissue regeneration, angiogenesis, and neurological issues. Local and systemic disorders can also contribute to the delay in healing. Due to rising reliance and greater hospital admissions, delayed wound healing and wound infection place a

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significant cost strain on health care systems. Additionally, the social and quality of life effects of chronic wounds on people's lives and occupations are highly significant [2].

Ayurveda has a chance to contribute thanks to the extensive selection of medications it has in the pharmacopeia. Comparatively speaking, synthetic materials are more sophisticated than natural ones. There is tremendous promise for the treatment of wounds using plants and their compounds. The healing and purification of wounds is a process in which several plants play a crucial part. Because they support the body's inherent mending systems, plants are more effective healers. Up to 80% of the population in underdeveloped nations today relies on medicinal herbs for their primary healthcare [3]. Wounds are referred to as *Vrana* (wound) in Ayurveda. It has been referred to as a key subject in many writing genres. *Vrana* damages bodily parts and destroys tissue while also discoloring the skin and causing damage to other body parts. Many medicinal plant parts are discovered to be beneficial in the treatment of wounds and wound healing. There should have *Vrana Shōdhana* (wound purifies/cleansing), *Krimighna* (destroy external and internal *Krimi*), or *Rakshōghna* (killing germs) qualities. Additionally, *Vrana Rōpana Guna* is required for healing purposes.

Vrana Shōdhana and *Rōpana Upakrama* (methods) are referenced in *Ayurvedic* scriptures as principles for managing wounds. *Vrana Shōdhana* is the term for the wound cleaning procedure, which removes slough, debris, and other foreign objects to create a conducive environment for healing. Medication, para-surgical, or surgical techniques are used to accomplish this. The medications known as *Vrana Rōpana* pharmaceuticals are those that speed up the healing process [4].

The *Susruta Samhitā* (classical text) states that there are sixty different types of wounds that can be treated medically. Additionally, *Kalka* (applying medicine paste) is one of the sixty methods that is helpful in the management of *Vrana*. Out of these, the *Kasāya* (decoction), *Varti* (wick), *Kalka* (paste), *Sarpi* (ghee), *Taila* (oil), *Rasakriyā* (linctus), and *Avacurna* (powder) measures are used to help with the granulation (*Rōpana*) and purification (*Shōdhana*) of wounds [5].

Natural products with medical characteristics help speed up the healing of wounds. Numerous investigations on the anti-inflammatory, antioxidant, antibacterial, and pro-collagen synthesis effects of natural products on wound healing have been done. Their bioactive phytochemical components from several chemical families, including as alkaloids, essential oils, flavonoids, tannins, terpenoids, saponins, and phenolic compounds, may be responsible for their therapeutic qualities. Each bioactive substance may have a unique role in the properties of wound healing. For instance, tannins and flavonoids have antiseptic and antibacterial properties, whereas saponins can promote the synthesis of pro-collagen. These phytochemicals can change one or more stages of the healing process for wounds.

Allopathic medicine holds that bacteria are to blame for wound infections. *Staphylococcus aureus* (*S. aureus*), one of them, is recognized as a major source of wound infections. Therefore, it is crucial that the medication has an effect of preventing *Staphylococcus aureus*, a wound-healing bacteria. By using Ayurvedic medicine, we can treat wounds effectively. In "*Bhāvaprakāsha*," there are numerous formulas for diseases connected to wound healing. Most of these formulations haven't undergone rigorous scientific testing to determine their effectiveness in managing wound healing. Consequently, the particular herbal mixture is chosen for this study.

It is said that applying a paste made of *Thila* (*Sesamum indicum*), *Saindhava Lavana* (rock salt), *Yastimadhu* (*Glycyrrhiza glabra*), *Nimbapatra* (*Azadirachta indica*), the two varieties of *Nishā* (*Haridrā: Curcuma longa*, *Dāruharidrā: Berberis aristata*), and *Trivrit* (*Operculia turpethum*) made in to a paste added with ghee and applied heals the wound

Aims and objectives

The study was created to determine the wound healing activity of the ingredients in selected herbal formula in the management of wound.

2. Research methodology

The literary review was referred through authentic Ayurveda classics such as, *Charaka Samhitā*, *Susruta Samhitā*, *Ashtānga Hrdya Samhitā*, *Bhāvaprakāshaya* and Ayurveda Pharmacopeia. The review on wound was conducted through recent scientific explanations and findings which published in official websites and indexed journals, articles, books, reports of WHO and encyclopedias. The gathered information was compared with traditional and modern scientific explanations using based on pharmacological characteristics, *Rasa* (taste), *Guna* (quality), *Veerya* (potency), *Vipāka* (last taste) and *Prabhāva* (specific action).

3. Review

Herbal Formula chosen from an authentic book, *Bhāvaprakāshaya* has eight ingredients: (Table 1).

Table 1 Review of selected herbs

	<i>Sesamum indicum</i>	<i>Glycyrrhiza glabra</i>	<i>Azadirachta indica</i>	<i>Curcuma longa</i>	<i>Berberis aristata</i>	<i>Operculia turpethum</i>
Family	Pedaliaceae	Fabaceae	Meliaceae	Zingiberaceae	Berberidaceae	Convolvulaceae
Sanskrit name	<i>Thila</i>	<i>Yashtimadhu</i>	<i>Nimba</i>	<i>Haridrā</i>	<i>Dāruharidrā</i>	<i>Trivrit</i>
Part used	Seeds	Root	Leaves	Rhizome	Root, Stem,	Root, Bark, Leaves

3.1. *Sesamum indicum* (*Thila*)

A perennial or sporadic annual shrub with a height range of 50 to 250 cm, sesame is a member of the Pedaliaceae family. Its morphology is incredibly diverse. The sesame plant can either have branches or not. The leaves are hairy on both sides and range in shape from ovate to lanceolate. The plant emits a disagreeable odor. As long as the weather cooperates, leaves, flowers, and seeds will be generated in an undetermined growth sequence. At maturity, the color of the leaves and stems changes from yellow to red. The foxglove-like, purple to pale flowers are followed by 3 cm capsules or fruits that contain numerous seeds. Each plant has the potential to produce 15–20 fruits with 70–100 seeds each. When the stems are cut and hung upside down for the ripe seeds to fall out and be collected on mats, it matures in 80–180 days [6]. Sesamin and sesamol are two further unique compounds found in sesame seeds. Its seeds have 16–18% carbs, 50–52% oil, 17–19% protein, and 0.1–0.5% fatty acids. *Tila's Pancha Padārta* (five elements of herbs) is *Guru* (heavy) and *Snigdha* (oily) *Guna* in *Rasa Madhura* (sweet). *Ushna* (hot) is everywhere. *Madhura* is in the *Vipāka* and *Kēshya* (grows hair) is in the *Prabhāva*. *Dōshanurupa Karma* (action according to humor) is *Vāta Shāmaka* (pacify body humors) and *Pitta Kapha Kōpa* (aggravate body humors).

The oil has been used for thousands of years to treat wounds. For common skin pathogens like *Staphylococcus* and *Streptococcus* as well as common skin fungi like athlete's foot fungus, it is naturally antibacterial. It has antiviral and anti-infectious properties [7]. Sachin & Shivanand assessed the *Sesamum Indicum* Seed Extract's wound-healing capacity. The findings showed that the percentage of wound contraction, duration of epithelialization, and tensile strength of skin in the incision model were comparable to those of the standard-treated group and other groups, respectively.

Antioxidants have been demonstrated to aid in the healing of wounds. The possible antioxidant activity of sesame oil extract aids in preventing oxidative damage and accelerating the healing process. Both the seeds and the oil of *Sesamum Indicum* help experimentally caused rats' wounds heal. Elhanafi et al.'s evaluation of *Sesamum indicum* seeds' anti-inflammatory and antioxidant properties was published in 2020. The inflammation caused by carrageen in rats was greatly reduced by the same extract, demonstrating its anti-inflammatory and antioxidant properties [8].

3.2. *Glycyrrhiza glabra* (*Yashtimadhu*)

Plant is a tall perennial herb, measuring about 2 meters. Plants thrive in arid, sunny climates with moist, deep soil. It produces flat pods, white to purple flower clusters, and oval leaflets. It possesses a thick network of underground roots, including a primary taproot and several runners. The primary taproot is soft, fibrous, and has a bright yellow interior. It is gathered for medicinal purposes. It is a useful herbal medicine. rhizomes, rootlets, stolons, and other components. *Glycyrrhiza glabra* Linn. roots include five novel flavonoids, liquirtin, isoliquertin, liquiritigenin, and rhamnoliquirililn, as well as glycyrrhizin, a saponin that is 60 times sweeter than cane sugar. *Pancha Padārta* of *Yashtimadhu* is *Madhura* in *Rasa* have *Guru* and *Snigdha Guna*, *Sheetha* (cold) in *Veerya*, *Madhura* in *Vipāka*. *Dōshanurupa a Karma* is *Vāta* and *Pitta Shāmaka* [9].

One such plant, *Yashtimadhu* (*Glycyrrhiza glabra*), has demonstrated exceptional efficacy against a wide range of species, including bacteria, fungus, viruses, parasites, etc. One such plant that embodies all that is wonderful in nature is *Yashtimadhu* [10]. Previous studies have examined the antimicrobial properties of roots and rhizomes [11]. Aqueous and ethanolic extracts of liquorice exhibit inhibitory effect on cultures of *Staphylococcus aureus* and *Streptococcus pyogenes*, according to in vitro investigations [12].

As opposed to the control group, glycyrrhizic acid ammonium salt (GA) increases ulcer contraction, epithelization, and ulcer breaking strength, as shown in this study's excision and incision ulcer healing models [13]. According to Ju, H.S., the flavonoids in liquorice are currently the most potent natural antioxidants. In order to effectively prevent skin and hair from oxidative damage, cosmetic products can be made with licorice extract.

Additionally, it is accountable for indirectly preventing platelet aggregation. According to reports, the glycyrrhetic acid analog carbenoxolone (Biogastron) inhibits 15-hydroxyprostaglandin dehydrogenase and prostaglandin, two enzymes crucial for prostaglandin metabolism, hence increasing prostaglandin levels. Prostaglandins promote cell growth and mucus secretion. This encourages ulcer repair.

3.3. *Azadirachta indica* (Nimba)

The majority of tropical and semi-tropical nations have neem trees, which are evergreen trees. It is a fast-growing tree and one of only two species in the genus *Azadirachta*. Although it is evergreen, extreme drought may cause most or almost all of its leaves to fall off [14]. Neem trees can grow to a height of 12 to 18 meters and have a circumference of 1.8 to 2.4 meters. Neem is a blooming plant that blooms between three and five years old [15]. Neem phytochemical studies have shown that the plant's entire body contains bitter components. Indicas contain a variety of phytochemicals, including tannin, flavonoids, alkaloids, triterpenoids, and glycosides. According to fundamental *Ayurvedic* texts, *Kashaya* (astringent) in *Rasa* has *Laghu* (light) *Guna* and *Nimba's Pancha Padārtha* is *Tikta* (bitter), *Sheetha* in the scene, *Vipāka* in *Katu* (pungent), *Dōshānurupa Karma* is *Pitta Shāmaka* and *Kapha*.

Because of its antibacterial qualities, *Azadirachta indica* leaf may be utilized to reduce bacterial pollution of the air in a home setting. According to B. Singh et al., neem seeds are used in traditional medicine to cure infections, particularly those that affect the eye and ear. Neem leaf water that has been boiled is a great antiseptic for cleaning wounds, reducing swelling, and treating skin issues [16]. Neem leaf and its constituents have been shown to exhibit immuno-modulatory, anti-inflammatory, antihyperglycemic, anti-ulcer, anti-malarial, antifungal, antibacterial, antiviral, antioxidant, anti-mutagenic, and anti-carcinogenic properties, according to Subapriya and Nagini's review of the medicinal properties of *Azadirachta indica* (neem) leaves published in 2001. *Azadirachta indica* and *Acalypha indica* water and acetone extract were shown to inhibit *Staphylococcus aureus* and *Pseudomonas aeruginosa's* antimicrobial activity by Raut [17].

Neem extracts are abundant in antibacterial chemicals since research has conclusively demonstrated that they may be useful in controlling some foodborne pathogens and other spoilage organisms [18]. Manogaran et al, assessed the anti-inflammatory properties of *Azadirachta indica* root, bark, and leaves. The root, bark, and leaves of *Azadirachta indica* were extracted in 50% acetone, which produced noticeable anti-inflammatory action [19]. Additionally, it was discovered in a different study comparing the antioxidant activities of methanolic and chloroform extracts of neem leaves Bello et al., that methanolic extracts greatly outperform chloroform extracts [20].

3.4. *Curcuma longa* (Haridrā)

Known botanically as *Curcuma longa* Linn of the Zingiberaceae family and more often known as curcumin or turmeric, *Haridrā* is one of the traditional herbal medicines [21]. Rhizome is a useful component of *Haridrā*. Its rhizomes have an elongated shape, are thick and meaty, and are covered in a rough, segmented skin. It is brownish-yellow on the outside and pale orange on the inside. Rhizomes come in two varieties: round turmeric, which is the basic rhizome, and long turmeric, which consists of lateral branches of the rhizome. Its rhizomes are mostly composed of 2% to 6% curcuminoids, 60% to 70% carbohydrates, 6% to 8% proteins, 3% to 7% essential oils, 5% to 10% fixed oils, 2% to 7% fiber, and 3% to 7% minerals.

Its flavor (*Rasa*), according to Ayurveda is *Tikta* (bitter) and *Kashāya* (astringent), *Laghu* (light) qualities and *Ushna* (hot) potency are present. *Pittashāmaka* due to bitter flavor; *Kapha Shāmaka* due to heated potency, post-digestive action, and bitter taste. *Vipāka*, or the after-digestion impact, is pungent. According to Ayurveda literature, it has a particular anticoagulant activity that makes it useful for treating skin problems, blood disorders, and wound healing [22]. *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Klebsiella pneumonia* were all susceptible to the antibacterial effects of *Curcuma longa's* aqueous extract using methanol to extract. According to Sidhu El et al., turmeric has an inhibiting effect on *Bacillus subtilis* and *Staphylococcus aureus*. Sidhu El et al. found evidence that curcumin can facilitate the development of granulation tissue, collagen deposition, tissue remodeling, and wound contraction. Curcumin has strong analgesic and anti-inflammatory properties. In comparison to untreated wounds, Sidhu et al. found that the localisation of transforming growth factor beta and fibronectin, two crucial factors in wound healing, increased in curcumin-treated wounds. In an effort to clarify the mechanism of curcumin's wound healing function, Phan et al. examined the effects of curcumin on damage caused by hydrogen peroxide and hypoxanthinexanthine oxidase to cultured human keratinocytes and fibroblasts.

Through the induction of transforming growth factor-beta, which promotes angiogenesis and the formation of extracellular matrix during the remodeling phase of wound repair, Thangapazham et al. demonstrated the positive effects of curcumin as a proangiogenic agent in wound healing.

Panchatcharam et al discovered that wounds treated with curcumin healed significantly, as evidenced by faster rates of epithelialization, wound contraction, and enhanced tensile strength. According to Labban, C. I. nga's anti-inflammatory activities can be related to its capacity to suppress both neutrophil function in inflammatory situations and the manufacture of inflammatory prostaglandins from arachidonic acid. Strong antioxidant activity, comparable to that of vitamins C and E, is demonstrated by water- and fat-soluble preparations of turmeric and its curcumin component. The antioxidant effects of curcumin [23].

3.5. *Berberis aristata* (Dāruharidrā)

Since ancient times, the Indian medicinal plant *Berberis aristata* (*B. aristata*), a member of the Berberidaceae family, has been utilized in *Ayurvedic* medicine. According to Potdar et al, it is also known as Indian berberi, *Dāruharidrā*, *Dāruhaldi*, *Dārvi*, and *Chitra*. Over the Himalaya, widely dispersed between altitudes of 1,850 to 3,300 m. It is a sizable deciduous shrub with a stem diameter of 10 to 20 cm and a height of between 1.8 and 3.6 m. Because of its antibacterial, antiprotozoal, antidiarrheal, and antitrichoma properties, it has been employed in *Ayurvedic* and Chinese medicine. Protoberberine and an alkaloid of the bis isoquinoline class are found in *Berberis aristata*. From basic *Ayurvedic* books, *Pancha Padārtha* of *Dāruharidrā* is *Tikta* and *Kashāya* in *Rasa* have *Laghu* and *Rūksha* (dry) *Guna*, *Ushna* (hot) in *Veerya*, *Katu* in *Vipāka*, *Dōshanurūpa Karma* is *Kapha* and *Pitta Hara* [24].

According to Aydemir and Biloglu, it has demonstrated considerable antibacterial and antifungal properties against *Staphylococcus aureus* and *Candida* spp. *Berberis aristata* stem extract was effective against *Bacillus cereus* and *Streptococcus pneumonia* while *Berberis aristata* root extract demonstrated low MIC values against *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus flavus*, and *Bacillus cereus*. On the basis of clinical observation, the rate of healing, and changes in histomorphological traits, the effectiveness of wound healing was assessed in a study on male adult goats. In order to promote wound healing, aqueous and alcoholic extracts were applied topically to open wounds [25]. According to Komal et al., the *Berberis aristata* plant has a moderate amount of antiproteolytic action against the trypsin-induced hydrolysis of bovine serum albumin.

A 50% aqueous ethanolic root extract of *Berberis aristata* was investigated for its antioxidant properties. Strong potential exists for the root extract of *Berberis aristata* to reduce oxidative stress. According to Komal et al., the antioxidant ability of dried aerial parts of *Berberis aristata* was examined in aqueous and methanolic extract as well as berberine, against CCl₄-induced liver injury [26].

3.6. *Operculina turpethum* (Trivrit)

It has a simple stem, triangular stems, or rectangular stems, and is a perennial scented creeper.

There are several of the oval-shaped, 2 to 5 inch long leaves. It is made up of cylindrical pieces of root and stem that are 1.5–15 cm long and 1–5 cm in diameter. The central woody portion is frequently removed by splitting the bark on one side. The external surface is longitudinally furrowed, giving the drug a rope-like appearance. The bark and wood are fractured, and the odor and initial flavor are both distinct but unpleasant or musty. Turpethinic acid and its derivatives, scopoletin, a coumarin derivative, and other compounds were isolated from the plant. Turpeth root contained a volatile oil, albumen, starch, a yellow coloring substance, lignin, salts, and ferric oxide, according to Boutron-Chalard. From basic *Ayurvedic* books, *Pancha Padārtha* of *Trivrit* are *Madhura*, *Katu*, *Tiktha* and *Kashāya* in *Rasa* have *Laghu*, *Rūksha*, *Thikshna* (sharp or penetrating), *Sara* (spreading) *Guna*. *Ushna* in *Veerya*. *Katu* in *Vipāka*. It is a *Vāta* and *Pitta* moderator.

Rats with formalin-induced edema were tested by Rajashekar et al. in to determine the anti-inflammatory properties of OT root powder. They carried out an experiment in which 100 mg/kg of body weight of root powder and its *Ayurvedic* polyherbal preparation (*Avipattikar Churna* (a kind of powder) were given orally to rats. The findings revealed a remarkable reduction in the volume of formalin-induced edema, at 36.45% and 27.11%, respectively [27]. The extracts were tested against numerous human pathogenic bacteria, and Jahangir Alam et al. reported that the minimum inhibitory concentration (MIC) ranged from 0.1 to 0.75 mg/ml. Ezeja et al. examined the methanolic extract of leaves from *Operculina turpethum* for its analgesic and antioxidant properties. The study showed that *Operculina turpethum* possesses analgesic and antioxidant properties and confirmed the folkloric use of *Operculina turpethum* leaves in the traditional pain management [28].

3.7. Saindhava lavana (rock salt)

The term "*Panchalavana*" (five types of salt) refers to the five main forms of *Lavana* (salt) that are referenced in Ayurveda. Rock salt, or *Saindhava Lavana*, is thought to be the greatest. It is a hard, yellowish red, rocky, salty substance that dissolves in water. According to Amrutha et al. *Saindhava Lavana* possesses the qualities of *Madhura Rasa* (sweet taste), *Sheeta Veerya* (cold potency), *Snigdha* (unctuous), and *Laghu* (lighter for digestion). According to Amrutha et al., it functions therapeutically as *Hrudya* (good for heart) *Vrshya* (increase sexual power), *Netrya* (good for eyes), *Ruchiprada* (increase appetite), and *Vranadōshahara* (reduce wounds) [29].

Dead skin cells are removed, pores are cleaned, and the natural skin layer is protected, resulting in a healthy and energizing skin type. It also aids in regenerating skin tissue to make skin appear younger and firmer. It helps in getting rid of toxic minerals and refined salt deposits by stimulating blood circulation and mineral balance [30].

3.8. Cow Ghee

Cow Ghee is a butter alternative that is semi-liquid and free of lactose, water, and other milk particles. Butter is heated slowly until it turns into a clear, golden liquid to make it. Cow ghee is thin, pure, and does not quickly go rancid. Cow ghee has a pleasant aftertaste, is chilly to the touch, and has a sweet flavor. According to Makkalkar et al., it is regarded as calming, velvety, and oily. The benefits of cow ghee according to Ayurveda include: *Madhura*, *Guru*, *Snigdha*, *Mirdu* (soft), *Sheeta*, *Madhura* in *Vipāka*, *Agnideepana* (increase digestive power), *Anubhisyyandi* (sticky), *Ayushya* (increase life span), *Balya* (increase strength), *Cakshushya* (good for eyes), and *Deepana* in *Karma*. Because the fundamental ingredient in *Ayurvedic* intoxication treatments is ghee, which detoxifies the body and prevents allergies and inflammation [31]. Additionally, improve digestion and lower metabolism throughout the body. Ghee is renowned for its ability to promote *Rōpana* (healing) and its efficiency in speeding up the healing of wounds. Ghee contains a variety of saturated and unsaturated fatty acids that can participate in the metabolic procedures necessary for the healing of any wound. Therefore, it would appear desirable to investigate cow ghee further as a useful therapeutic agent [32].

4. Results and Discussion

The ingredients of the selected formula possess *Madhura Rasa* (62.5%), *Tikta Rasa* (50%) and *Katu Rasa* (25%), *Kashāya Rasa* (37.5%). According to *Guna* it Possesses *Laghu* (62.5%), *Snighdha* (50%), *Guru* and *Rūksha Guna* (37.5%). *Tikshna Guna* (12.5%). Among the analyzed ingredients *Ushna Virya* and *Sheetha Virya* 50%, *Katu Vipāka* 50% and others having *Madhura Vipāka* 50%. it possess mainly *Kapha Shāmaka*, *Pitta Shāmaka* (75%), *Vāta Shāmaka* (62.5%) and predominant *Dōshagnata* is balance of *Kapha* and *Pitta*. According to Ayurveda in *Dushta Vrana* (unclean wound), *Dushta* is one in which there is localization of *Dōsha Vāta*, *Pitta* and *Kapha*. And for wound healing, it should be balanced these *Dōshas*. Deranged *Dōshas* cannot be treated with a single drug all the times. According to analyzed data, this formula possesses to pacify mainly *Kapha*, *Pitta Dōshas*, and also *Vāta Dōsha*. Drugs which contain *Katu*, *Tikta*, *Madhura*, and *Kashāya Rasa* are more useful for wound healing processes. *Rōpana* is always associated with *Shōdhana* because a wound cannot be healed if it is not *Shuddha* (clean).

At the end of *Shōdhana Chikitsā* (treatment), *Vrana* becomes *Shuddha Vrana* and *Rōpana Cikitsa* has to be followed further. Mainly *Kashāya Rasa*, *Rūksha*, *Guru Guna*, *Sheetha Virya* and *Katu Vipāka* gives *Vrana Rōpana* and *Vrana Shōdhana* action. *Kashāya Rasa* and *Rūksha Guna* clears *Kledata* (moist) in *Vrana*. *Guru* and *Sheetha Virya* joins the torn tissues together, Once the *Klédatha* is lost the tissue starts growing. It is supplied by the *Raktha* (blood) Purified with *Kashāya Rasa*. The *Puya* (pus) is dried up due to *Rūksha Guna*. *Madura* rasa promotes the healing of torn tissues by supplying nutrition and Pacifies *Pitta* and nourishes the tissues. *Tikta Rasa* dries up (*Shōshana*) the *Kinnata* of *Kapha* and *Raktha*. It also does *Kapha Harata* and *Raktha Prasādana*. Thus it produces hostile conditions for *Krimi* (worms or micro-organisms) and further production of *Krimi*. In the Process of healing the wound the *Katu Rasa* removes additional tissue slough and promotes healthy tissue growth. This is also achieved by enhance circulation of *Rakta* and *Krimi* is produced when *Kapha* and *Klēda* is increased. *Katu Rasa* removes *Klēda* and diminishes *Kapha*. Also, *Laghu Guna* is a more prominent *Guna* in the selected formula. It suppresses *Kapha* and also helps in healing of wounds. *Katu Rasa*, *Snighda*, *Ushna Guna*, *Ushna Virya* and *Katu Vipāka* gives *Shōtha Hara* (reduce swelling) action. Therefore *Shōthahara* drugs usually have anti-inflammatory as well as analgesic effect with theses specific actions swelling; pain like symptoms of wound can be managed. Wound healing process can be facilitated by natural products with medicinal properties. Many studies on the wound healing properties of natural products with anti-inflammatory, antioxidant, antibacterial and pro-collagen synthesis actions have been conducted.

When considering specific actions related to wound healing, The ingredients of the selected formula possess anti-oxidant activity (100%), anti-inflammatory action (87.5%), anti-bacterial and wound healing activity (75%). The above described many components are *Madhura*, *Tikta*, *Kashāya* and *Katu Rasa*. They are *Vrana Shōdana Rōpana Krimighna*

(reduce worms) and proved by many authentic Ayurveda texts. Previous researches have proved that, individually these ingredients have anti-bacterial, anti-inflammatory, anti-oxidant, wound healing properties. In *Susrutha Samhitā*, *Yastimadhu* is also categorized under *Nygrōdadi Gana* (a drug class). This *Gana* has the properties of *Sangrāhi* (collect together) and good for *Vrana*. *Haridrā*, *Dāruharidrā* and *Nimba* are mentioned in *Lakshādi Gana* (a drug class).

These *Lakshādi Gana Dravyās* have *Kashāya Madura*, *Tikta Rasa*. It can be destroyed *Kapha*, *Pitta* and *Krimi* as well as use to cleansing *Dushta Vrana*. *Nimba* is specially categorized under the *Āragvadadi Gana* (a drug class). It has the *Vrana Shōdana* (wound cleansing) and *Krimighna* properties. The pharmacopeia text also described the same things. *Tila* is externally acted as *Snehana* (oily), *Vedanāsthāpana* (reduce pain), *Sandhāniya* (union of fractures), *Vrana Shōdhana*, *Vrana Rōpana*. *Trivrth* also has the *Krimighna Guna*. The *Sahindava Lavana* has the cold in potency, subtlety, unctuous and also ghee has *Brmhana* (nourishing) property (nourish the human body and tissues). They are help to cleanse and heal the wound. The pharmacological properties and actions of the ingredients of the selected formula effectively served as a valuable source of information. Hence helpful in the management of Wounds.

5. Conclusion

According to the literature review, due to its *Kapha Pitta Vāta Shamana Karma* with *Shōtahara*, *Vrana Rōpana*, *Vrana Shōdana* *Vedanāsthāpana*, *Krimighna* actions, and pharmacological action for wound healing selected *Ayurvedic* formula is highly effective in the management of Wound healing as an external application mentioned in *Bhāvaprakāsha*.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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