

A Polyherbal Approach to Burn Wound Healing: Formulation and Evaluation of Cream Containing *Chenopodium album*, *Praecitrullus fistulosus*, and *Aloe barbadensis*

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Abstract:

Burn is a destruction of the physical structure of the skin. Burns are classified into four degrees based on depth ranging from superficial to deep tissue damage are first-degree burn, second-degree, third-degree and fourth-degree. The pathophysiology of burn involves inflammatory response mediated by cytokines, increased vascular permeability and edema formation. As conventional burn cream has topical antibiotics silver sulfadiazine are effective but have side-effects such as delayed healing and hypersensitivity, which increase the focus on herbal burn cream as safe alternative. This study focus on the formulation and evaluation of herbal burn cream using *Chenopodium album*, *praecitrullus fistulosus* and aloe-vera. Aloe-vera promotes wound healing by collagen synthesis and also has moisturizing property. *Chenopodium album* have anti-inflammatory, antimicrobial and antioxidant activity and *praecitrullus fistulosus* promotes healing through tannins. The extract was prepared by ethanol extraction and then incorporated into cream base. The formulated herbal burn cream was found to be safe, stable and effective and serve as a natural alternative to synthetic burn treatment

Keywords:

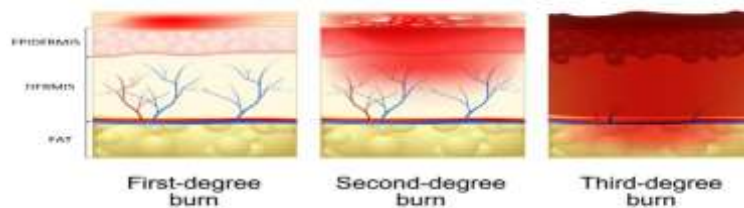
Herbal burn cream, *Praecitrullus fistulosus*, aloe vera, *Chenopodium album*

1. Introduction:

The largest organ of human body is skin that protect the body from external environment. Burn injury, chronic wound, excision, tumors, etc. are include in skin trauma. Burn wound is serious destruction of the physical structure of the skin that cause breaking of skin.¹ Burn is caused by the electric shocks, high temperature changes, explosion or chemical exposure. According to American Burn Association, in united state 486,000 cases of burn are received. Due to burn injury 3,240 deaths occur annually.² The first physiological barrier which protect body against foreign microorganism is damaged by burn injury to the skin. Therefore, the burn management become most important concern. Antibiotic therapy is one of the main approaches for treatment and prevention of burn wound by application of topical antibiotics. The mostly used topical antibiotics for burn wound treatment is silver sulfadiazine which have some limitations such as delayed and incomplete epithelization, generation of black scars, hypersensitivity and thrombocytopenia. Other than silver sulfadiazine other topical antibiotics such as mefanide acetate and silver nitrate also show some side-effects including pain, hypersensitivity and delayed wound healing.^{3,4}

Because of these adverse effects of synthetic topical antibiotics, herbal burn cream gaining attention of user as it is a safer alternative for burn management. Several medicinal plants and their extract have potential for management and treatment of burn injury including *Chenopodium album*, *coccinia indica*, *Momordica dioica*, *praecitrullus fistulosus* and *trichosanthes dioica*.⁵

The main aim of this study the formulation of herbal burn cream using *praecitrullus fistulosus*, *Chenopodium album* and *aloe-vera*.



1.1. Classification of burn:

Burn injury is a physical injury which cause skin breaking. On the basis of depth, burn can be classified as first-degree, second degree, third degree and fourth degree burn.⁶

- i. First-degree burn:
It is also known as superficial burn which damage only outermost layer of skin. The example of this burn is sunburn.⁷
- ii. Second-degree burn:
It is partial thickness burn, it damage both dermis and epidermis layer. It is characterized by the blister formation and redness.⁶
- iii. Third-degree burn:
It is full thickness burn may penetrate to deepest layer of skin.
- iv. Fourth-degree:
In this burn can penetrate to the deeper layer of skin, it may include bone and muscle. As nerves also get destroyed, there is no feeling there.⁸

Fig. Burn classification

1.2. Pathophysiology of burn:

Burn injuries can cause both local and systemic effects

Local effect of burn:

The site of burn injury can be divided into three zones were described by Jackson in 1947.

-Zone of coagulation:

In this zone protein get coagulated and cause irreversible tissue loss.

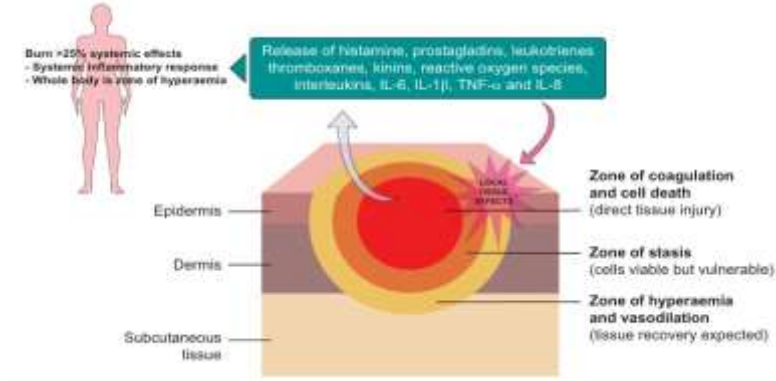
-Zone of stasis:

It is ischemia damage. burn prevent damage.

-Zone of

This show

perfusion and recovery is expected.⁹



characterized by due to microvascular This zone helps in resuscitation and any irreversible

hyperemia:




outermost zone increased tissue

Burn injuries can cause release of inflammatory mediators called cytokines which is responsible for inflammatory reaction. Cytokines released in acute inflammation are TNF- alpha, interleukin-1, IL-6, etc. This cascade of inflammation is started by activation of nuclear factor kappa beta. Additionally, neutrophils, macrophages, mast cell, prostaglandin and vasodilators are activated which cause increase in vascular permeability at the site of injury. Enhanced vascular permeability cause leakage of exudative fluid into injured tissue result in edema.¹⁰

2. Material and method:

2.1. Plant Profile:

S.no	Plants	Biological source and chemical constituents	Uses

<p>1.</p>	<p>Aloe-vera</p>	<ul style="list-style-type: none"> ○ Aloe barbodensis ○ polysaccharides, pectic acid or glucomannans¹² 	<ul style="list-style-type: none"> ○ wound healing, anti-inflammatory, antioxidant, anti-diabetic and anti-ulcer.¹¹ ○ Aloe-vera can increase the wound healing by increasing the collagen content and collagen cross linking result in enhanced wound contraction.¹³ 	
<p>2.</p>	<p>Chenopodium album (Bathua)</p>	<ul style="list-style-type: none"> ○ Chenopodium album Linn. ○ Triterpenoids, flavonoids and phenolic compounds. 	<ul style="list-style-type: none"> ○ Chenopodium album possesses potential anti-inflammatory, anti-proliferative, anti-septic, antifungal, anti-allergic and other properties.¹⁴ 	
<p>3.</p>	<p>Praecitrullus fistulosus (Tinda)</p>	<ul style="list-style-type: none"> ○ Praecitrullus fistulosus belongs to Cucurbitaceae family contain many phytochemicals such as tannins, cardiac glycoside, terpenoids, carbohydrate, resin, saponins, carotenoids and phytosterol. 	<ul style="list-style-type: none"> ○ Acceleration of wound healing ○ Minimize the oxidative stress and cellular damage.¹⁵ 	



2.2. Preparation of plant

- Collect fresh leaves of *Chenopodium album* and fruit of *praecitrullus fistulosus* and dry them properly

- The

form

- The

- After them



extract:

dried leaf and fruit were converted into powder

powder form of plants is extracted using ethanol extraction method ethanol extraction filter out and evaporate ethanol.¹⁶

Fig. Extraction of *Chenopodium album*

Fig. Extraction of *praecitrullus fistulosus*

2.3. Preparation of herbal burn cream:

Properties of ingredients used in formulation

S.No.	Ingredients	Properties
1.	Chenopodium album	Anti-inflammatory agent
2.	Praecitrullus fistulosus	Antibacterial and soothing
3.	Aloe-vera gel	Healing and moisturizing property
4.	Castor oil	Emollient
5.	Liquid paraffin	Lubricant and softener
6.	Petroleum jelly	Occlusive agent
7.	Stearic acid	Emulsifier and cream base
8.	Beeswax	Emollient
9.	Glycerin	Humectant
10.	Sodium benzoate	Preservative
11.	Vitamin E	Antioxidant
12.	Purified water	Vehicle

Quantity of ingredients used in formulation:

S.No.	Ingredients	Formulation 1 (F1)	Formulation 2 (F2)	Formulation 3 (3)
1.	Chenopodium album	0.5 ml	0.5 ml	0.5 ml
2.	Praecitrullus fistulosus	0.5 ml	0.5 ml	1 ml
3.	Aloe-vera gel	7 ml	5 ml	5 ml



4.	Castor oil		1 ml	1 ml
5.	Liquid paraffin		10 ml	10 ml
6.	Petroleum jelly	5 gm	5 gm	3 gm
7.	Stearic acid	2.5 gm	2.5 gm	5 gm
8.	Beeswax	2 gm	2 gm	2 gm
9.	Glycerin	1.5 ml	3 ml	1.5 ml
10.	Sodium benzoate	50 mg	50 mg	50 mg
11.	Vitamin E	0.1 ml	0.1 ml	0.1 ml
12.	Purified water	~20-25 ml	~20-22 ml	~20 ml

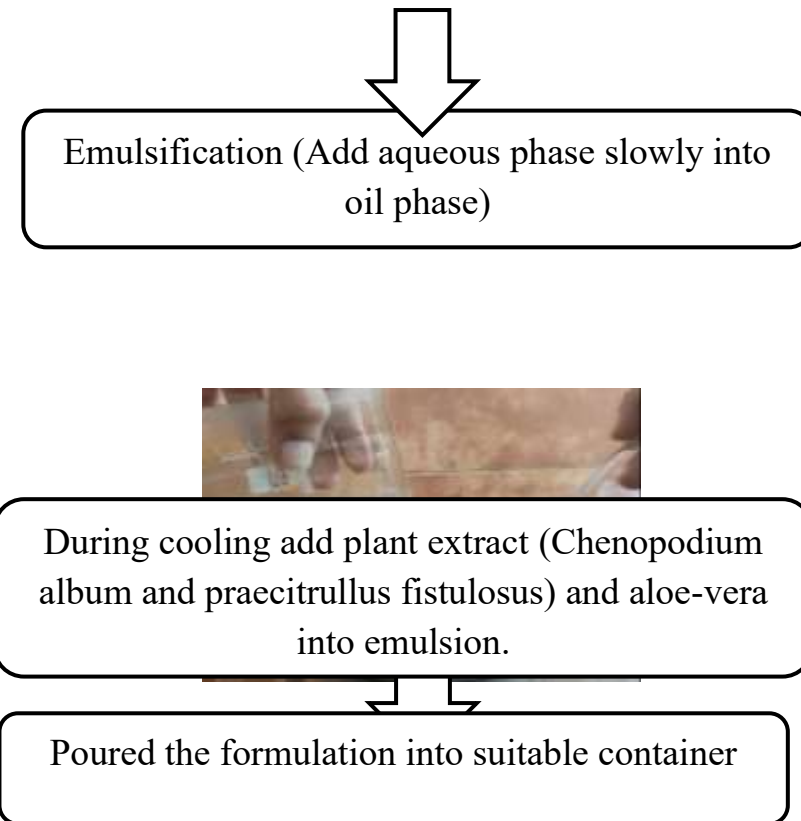
Formulation procedure:



Preparation of oil phase in China dish (Castor oil, liquid paraffin, petroleum jelly, stearic acid, beeswax, vitamin E)



Preparation of aqueous phase in another beaker (water, glycerin, sodium benzoate)



3. Evaluation of formulation:

Evaluation test for herbal burn determine its physical property, includes physical evaluation, irritation test of cream.

- Physical evaluation:
Physical evaluation formulation odor, color, The formulated cream odor and light green in
- PH determination:



cream was performed to stability and efficacy. It spreadibility, PH, stability and

involved examination of texture etc.¹⁷ was smooth in texture, slight color.

The PH determination was performed by digital PH meter. Small amount of formulation is taken in petridish and test for PH.

Fig: PH determination

Formulation	F1	F2	F3
pH	6.2	6.4	6.5

➤ Stability testing:

Phase separation of cream is examined for determination of its stability. The test is carried for 3 weeks.



S.no	Week	F1	F2	F3
1	1 st week	stable	stable	stable

2	2 nd week	stable	stable	stable
3	3 rd week	stable	stable	stable

➤ Spreadability:

Spreadability test is perform by placing cream in between two glass slides.

Formulation	F1	F2	F3
Spreadability	6.5	6.7 cm	6.3 cm

➤ Skin irritancy:

This test is performed to ensure that the formulated cream should not cause side effect or adverse reaction after its application.

Formulation	F1	F2	F3
Skin irritation	No irritation	No irritation	No irritation

4. **Result:**

The formulated herbal burn cream from *Chenopodium album*, *Praecitrullus fistulosus* and aloe-vera is the safe alternative to synthetic burn cream as it does not cause skin irritation and any other side effects. The formulated cream has smooth and desired texture. The evaluation test data show that the formulation was stable and doesn't cause any side effects.

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