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# A Review Article

# Pharmaceutical Creams and their use in Wound Healing

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## Abstract:

Since the beginning of time, creams have been used as topical medicines because they are simple to apply to the skin and remove. Pharmaceutical creams are used for many different things. They may be used cosmetically for things like cleaning, beautifying, changing appearance, hydrating, etc., or they can be used to protect skin from bacterial and fungal infections and to treat cuts, burns, and wounds. While human skin frequently gets damaged, it is also capable of healing itself. However, infection is a possibility, particularly in the early stages of an injury, and the natural healing process may take some time. In this case, creams can be administered to the wounded site for faster healing and protect against infection. In this review we have studied pharmaceutical wound healing creams with wound healing process, methods of preparation of creams, classifications based on heir function, characteristics, ingredient of cream and their evaluation parameter.

## Key words:

Creams, Skin, Wound healing, Topical drug delivery system.

## Introduction:

Creams are a type of topical medication that can be administered onto the skin. They are characterized as "viscous liquids or semi-solid mixtures, either of the oil-in-water or water-in-oil type," taking the form of lozenges with varying thicknesses depending on the composition of oil and water. [1] Creams are utilized for decorative purposes such as sanctification, enhancement of beauty, improvement of appearances, protection, or for remedial purposes. These topical formulations are employed to achieve a localized effect, delivering medicine to the underlying layers of the skin or mucous membrane. These products are specifically designed for topical application, ensuring targeted delivery of medication for the treatment of skin diseases. [2]

Cream is regarded as pharmaceutical products due to their formulation techniques derived from the pharmaceutical industry. Both medicated and non-medicated creams are widely utilized for the treatment of various skin conditions or dermatoses. Individuals choose to use ayurvedic, herbal, or allopathic creams based on their specific skin needs. These creams consist of one or more drug substances that are dissolved or dispersed in a suitable base. Creams can be categorized as either oil-in-water or water-in-oil emulsions, depending on their phases. Traditionally, the term "cream" has been used to describe semisolid formulations such as cold cream (water-in-oil) or vanishing cream (oil-in-water).[3] According to an examination of Medicare records, approximately 8.2 million individuals experienced acute or chronic wounds, resulting in costs reaching up to $96.8 billion. In Europe, an estimated 2 million people suffer from chronic wounds, whereas in the United States, it is estimated that approximately 2% of the entire population is affected by chronic wounds. [4,5]

The topical agent provides comprehensive overview of five distinct clinical activities in the field of wound care, namely:

1. Elimination of underlying cause of tissue breakdown, such as infection and inflammation
2. Alleviation patients pain.
3. Removal of necrotic tissue which impedes the filling process.
4. Facilitation of wound closure.
5. Promotion of the healing process.

## PHYSIOLOGY OF HUMAN SKIN:

### ❖ Epidermis:

The epidermis, consisting of stratified keratinised squamous epithelium, is the outermost layer of the skin. Its thickness varies across different regions of the body, with the palms of the hands and soles of the feet being the thickest. Although the epidermis lacks blood vessels and nerve endings, its deeper layers receive nourishment and oxygen from the interstitial fluid originating from the dermis. Additionally, this fluid drains away as lymph.

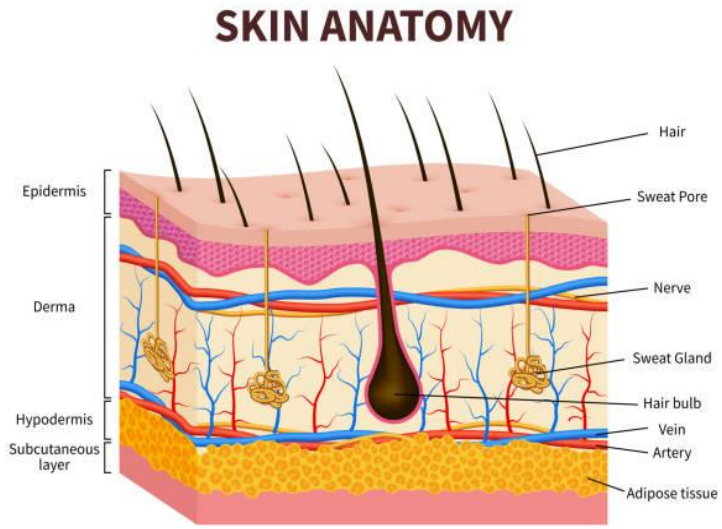


**Fig. 1 Skin Anatomy**

### ❖ Dermis:

The dermis, composed of connective tissue, is characterized by its toughness and elasticity. Within the matrix, collagen fibres are intertwined with elastic fibres. Overstretching of the skin leads to the rupture of these elastic fibres, resulting in the formation of permanent striae, commonly known as stretch marks, which can be observed during pregnancy and obesity. The collagen fibres play a crucial role in binding water and providing the skin with its tensile strength. However, as the skin ages, its ability to retain moisture declines, leading to the development of wrinkles. The dermis is primarily populated by fibroblasts, macrophages, and mast cells. Beneath its deepest layer, there is areolar tissue and varying amounts of adipose (fat) tissue.

### ❖ Subcutaneous surface:

The hair follicles are made up of cells that are secreted from the same tissue. The hair follicles produce sebum, an oily substance that can be found in the skin of all parts except for the palms and feet. The scalp, face, axillae, and groins are where they are most abundant. The transitional areas of the epidermis, including lips, eyelids, nipples, labia minora, and glans penis are where sebaceous glands can secrete sebum onto the surface without any involvement from hair follicles. [6]

## Function of skin:

### 1.Protection:

Langerhans cells in the skin serve as a crucial component of the adaptive immune system, forming and atomical barrier against pathogens and protecting the body from potential harm originating from the external environment.

### 2. Sensation:

The text encompasses a diverse range of nerve endings that respond to different stimuli such as heat and cold, touch, pressure, vibration, and tissue injury. For further information, please refer to the somatic sensory system and haptics.

### 3.Heat regulation:

The skin possesses an abundant blood supply that surpasses its actual needs, enabling accurate regulation of energy loss through radiation, convection, and conduction. When blood vessels dilate, perfusion and heat loss increase, whereas constricted vessels significantly decrease cutaneous blood flow and preserve heat.

### 4.Control of evaporation:

The skin acts as a moderately dry and partially impermeable shield against the escape of fluids. Impairment of this function plays a role in the extensive fluid depletion experienced in burn injuries.

## 5.Aesthetics and communication:

Our skin is visible to others, allowing them to make judgments about our emotional state, physical well-being, and level of attractiveness.

## 6.Storage and synthesis:

The skin functions as a storage center for lipids and water, in addition to serving as a site for the synthesis of vitamin D through the action of UV on specific areas of the skin.

## 7.Water resistance:

The skin serves as a crucial barrier that is resistant to water, thereby preventing the loss of vital nutrients from the body. (7)

## TYPES OF SKIN CREAMS:

❖ **Are divided into two types:**

1) Oil-in-Water (O/W) creams.

2) Water-in-Oil (W/O) creams.

## CLASSIFICATION OF CREAMS:

❖ **All the skin creams can be classified on different basis:**

1. According to function, e.g., cleansing, foundation, massage, etc.

2. According to characteristics properties, e.g. cold creams, vanishing creams, etc.

3. According to the nature or type of emulsion.

❖ **Types of creams according to function, characteristic properties and type of emulsion:**

1. Make-up cream (o/w emulsion):

a) Vanishing creams.

b) Foundation creams.

2. Cleansing cream, cleansing milk, Cleansing lotion (w/o emulsion).

3. Winter cream (w/o emulsion):

a) Cold cream or moisturizing creams.

4. All-purpose cream and general creams.

5. Hand and body creams.

6. Night cream and massage creams.

7. Skin protective cream.

### ❖ Oil-in-Water (O/W) creams:

Oil-in-Water (O/W) creams are characterized by the presence of tiny oil droplets dispersed within a continuous phase. This type of emulsion, known as an oil-in-water (O/W) emulsion, consists of oil droplets dispersed throughout an aqueous phase.

### ❖ Water-in-Oil (W/O) creams:

Water-in-Oil (W/O) creams consist of minute water droplets dispersed within a continuous oily phase. In the case where water serves as the dispersed phase and oil acts as the dispersion medium, the resulting emulsion is classified as a water-in-oil (W/O) type. [8,9,10]

### ❖ Make- up cream:

The emulsion primarily consists of o/w type and is a cream-based product that imparts a smooth and hydrated finish to the skin, whether it be a stain matte or luminous effect. It effectively nourishes the skin and is sweat-resistant, providing a long-lasting effect.

### ❖ Vanishing creams:

Vanishing creams, aptly named for their ability to seemingly vanish upon contact with the skin, are formulated with stearic acid. Once applied, these creams leave behind a dry yet slightly adhesive film that not only enhances the skin's texture but also possesses a drying effect. Consequently, these creams find particular utility in hot climates where perspiration is prevalent.

### ❖ Foundation creams:

The creams offered serve as an ideal foundation for make-up application. They function as an adhesive base for the application of make-up powders, while also providing emollient and protective

properties against environmental factors. The creams strike a balance between being neither too greasy nor too dry. They are designed to create a uniform complexion by covering flaws and altering skin tones, resulting in a multi-coloured make-up application on the face.

### ❖ Cleansing creams:

These creams serve the purpose of body cleansing and are utilized for personal hygiene and beautification, which holds significance in the realm of cosmetics. Cleansing creams or lotions are employed to eliminate make-up, surface grime, and primarily oil from the face and neck.

### ❖ Winter creams:

These creams, which lack a specific type of formulation, are characterized by a higher oil content compared to water content. Primarily intended for the treatment of chapped and dry skin, they are widely utilized.

### ❖ Cold cream:

Moisturizer or moisturizing cream is commonly referred to as cold cream, which is recognized for its emollient properties. Its application should result in a refreshing sensation, while ensuring that the oil layer formed on the skin is non-occlusive.

### ❖ All purpose creams and general creams:

These creams are currently more commonly utilized than in the past. They possess a slightly oily texture, yet are non-greasy, allowing for easy application onto the skin. Additionally, they can serve as night creams, nourishing creams, or protective creams for the prevention or alleviation of sunburns, as well as for the treatment of roughened skin areas.

### ❖ Hand and body creams:

One of the initial area to exhibit signs of aging are the hands. Throughout the day, we frequently cleanse our hands, inadvertently removing moisture. The application of cream serves to both soften and shield the skin, thereby maintaining a youthful appearance. Given that the skin on our palms and fingers necessitates oil to retain its flexibility and prevent dryness and fissures, it is advisable to utilize hand creams that replenish ample amounts of oil. Moreover, hand creams are predominantly employed on the hands in comparison to other regions of the body.

### ❖ Night cream or massage creams:

These creams are typically utilized to nourish the skin or as a remedy for dry skin. Night creams are those that are commonly applied to the skin and left on for a few hours overnight. Massage creams, on the other hand, are creams that act as an emollient when rubbed onto the skin with a massage.

### ❖ Skin protective creams:

These creams have been formulated to be smooth and thick in consistency, with the purpose of creating an invisible and uniform protective film barrier on the skin. This barrier serves to maintain a separation between the skin and any potential contaminants that may cause irritation, such as contact dermatitis or occupational dermatitis. Additionally, these creams work to enhance the natural properties of the skin and promote a balanced complexion for those with normal to combination skin types·

## ADVANTAGES AND DISADVANTAGES OF CREAMS AS A DRUG DELIVERY SYSTEM:

### ❖ Advantages of topical drug delivery system are as follow below:

- Topical formulation is very useful for delivery of rectal, vaginal drug delivery.
- It gives a high level of patient satisfaction
- It is safe and effective delivery of drug molecules with lower doses as compared to conventional system.
- Avoidance of gastro-intestinal incompatibility.
- Easily medicaments can be terminated when required.
- It is the easiest way to deliver a drug.
- It avoids first pass metabolism.
- It is non-invasive.

### ❖ Disadvantages of topical drug delivery system are as follow:

- Very slow absorption.
- Skin irritation or dermatitis may occur due to the drug or excipients.
- Most drugs have a high molecular weight and are poorly lipid soluble, so are not absorbed via skin or mucous membranes.
- Can be used only for those drugs which need very small plasma concentration for action. [11,12,13,14,15]

## GENERAL INGREDIENTS USED IN SKIN CREAMS:

- **The raw materials which are used in a manufacturing of skin creams are as follows:**
  - Water
  - Oil, fats and waxes
  - Mineral oil
  - Glyceride oil
  - Vegetable oil
  - Waxes
  - Fats
  - Landline
  - Colours
  - Emollients
  - Humectants
  - Perfumes
  - Vitamins
  - Preservatives

### ❖ Water:

This raw material is crucial and extensively utilized in the formulation of any cream. It is the most affordable and readily accessible option. In the case of skin creams, water serves as a solvent to effectively dissolve other cream ingredients. The water utilized in cream preparation is completely devoid of any toxins, pollutants, microbes, and similar contaminants. Additionally, water has the ability to create emulsions, with the type of emulsion formed depending on the quantity of water incorporated in the formulation. These emulsions are sometimes referred to as oil-in-water emulsions or water-in-oil emulsions, depending on the proportions of the oil phase and water phase utilized. [16]

### ❖ Oil, fates and waxes:

Oil, fats, and waxes constitute vital components of the cream. Waxes function as an emulsifier, while fats serve as a thickener, and oil acts as a perfuming agent, preservative, or other functions based on its role.

### ❖ Mineral oil:

Mineral oil, derived from petroleum oil, is a transparent, scentless, and extensively purified substance commonly employed in the cosmetics industry. It seldom triggers allergic responses and does not possess the ability to solidify or obstruct skin pores. Additionally, it is lightweight and cost-effective, aiding in the prevention of water loss from the body and maintaining optimal skin hydration.

A number of mineral oils are used in cream formulation are as follow,

- Heavy liquid paraffin
- Light liquid paraffin
- Liquid petroleum

### ❖ Glyceride oil:

Glyceride oil primarily consists of vegetable oils, such as almond oil, arachis oil, castor oil, coconut oil, and olive oil, among others. [17]

### ❖ Vegetable oil:

To maintain the plumpness of the skin, a barrier can be formed on its surface, which effectively slows down the loss of water. Additionally, vegetable oils such as almond oil, germ oil, avocado oil, and sunflower oil can be utilized to enhance the thickness of the lipid or oil component in creams or personal care products.

### ❖ Waxes:

The cream preparation involves the utilization of various modifiers such as beeswax, carnauba wax, ceresin, spermaceti, among others. These waxes are incorporated into cosmetics due to their ability to prevent the separation of oil and liquid components within an emulsion. Additionally, they contribute to the augmentation of the lipid portion's viscosity and adhere to the skin's surface, enhancing the overall thickness of the cream.

### ❖ Fats:

Different types of fats are utilized in the preparation of creams. These substances can be derived from animals, plants, or minerals. Glyceride oils and fats can originate from either animals or vegetables. They are composed of combinations of higher fatty acids and glycerine. Upon saponification, they can form soap or fatty acid and glycerine, depending on the process employed. The saturated group of fatty acids, including

lauric, margaric, palmitic, and stearic acids, are the most commonly found. On the other hand, oleic acid is a liquid and represents the most popular unsaturated fatty acid. In particular, olive oil, almond oil, sesame oil, peanut oil, cocoa butter fat, mutton tallow, lard, and beef stearin are the oils most frequently used in other cosmetic products.

### ❖ Lanolin:

Derived from wool fat of a sheep, lanolin comes in two types. The first type, known as hydrous lanolin, contains a water content ranging from 25% to 30%. On the other hand, anhydrous lanolin has a melting point between 38°C and 42°C and possesses a subtle odour. These components serve as a lubricant on the surface of the skin, resulting in a soft and smooth appearance. Additionally, lanolin aids in the formation of emulsions and seamlessly integrates with other substances utilized in cosmetic and personal care items.

### ❖ Colours:

Prior to the advancement of contemporary technology, natural sources such as turmeric, saffron, and indigo were the primary means of obtaining colours. However, in the 19th century, laboratory-produced colours emerged, which were discovered to possess superior stability and greater intensity. Furthermore, these colours could be generated without relying on the harvesting of wild plants.

### ❖ Emollients:

Emollients, commonly known as moisturizers, aid in the softening of the skin and the treatment of dry skin. Typically, emollients consist of oil or grease, including mineral oil, squalene, and lanolin. Their function involves enhancing the skin's capacity to retain moisture, forming a protective oil layer to prevent water loss, and lubricating the skin.

### ❖ Humectants:

Important multi-functional ingredients commonly found in most skin care formulations are humectants. Humectants are hydroscopic organic compounds that have the ability to absorb or retain moisture. These compounds offer various benefits such as moisturization and exfoliation. Examples of humectants include glycerine, Hydroxyethyl urea, betaine, sodium PCA, Sodium-L-Lactate, among others. In addition to their use in skin care products, humectants are also utilized in shampoos. Their purpose in

shampoos is to moisturize the hair and counteract the drying effect caused by surfactants. Furthermore, humectants assist in maintaining low temperature and freeze/thaw stability, acting as anti-freeze and ensuring the clarity of the shampoo even at low temperatures.

### ❖ Perfumes:

It is used in wide variety of products to impart a pleasant odour, mask the inherent smell of some ingredients. It is used in every type of cosmetics

Examples of natural perfumes used in creams are-

- White Blossoms
- Rosy Dreams
- Orange Blossom

### ❖ Vitamins:

Vitamins are crucial for maintaining the overall physiological function of the entire body and the skin. Cream formulations commonly incorporate vitamins such as A, B, C, E, and others.

### ❖ Preservatives:

Preservatives play a crucial role in cosmetics to prevent any changes caused by microorganisms and contamination during formulation, shipment, storage, and consumer use. Additionally, antioxidants can safeguard against alterations caused by exposure to oxygen. Synthetic preservatives, when used in low concentrations, are effective in preserving products and have a broad spectrum of activity against bacteria and fungi. Moreover, they are more affordable than natural preservatives. Natural preservatives cover a wide pH range, and consumers generally prefer them over synthetic preservatives. [18,19,20]

## RELEVANT METHODS OF PREPARATION OF CREAMS FOR WOUND-HEALING:

1) **Preparation of w/o emulsion creams**
2) **Preparation of o/w emulsion creams**

**1] Preparation of w/o emulsion creams:**

The oil-soluble constituents and emulsifier are combined and melted at 75°C in one beaker, while water and water-soluble components are melted at the same temperature in another beaker. Once melted, the water phase is transferred to a mortar and pestle and gradually mixed with the oil phase until a clicking sound is heard. The perfuming agent is added once the cream has cooled to an appropriate temperature. This method results in a preparation with a higher oil phase and lower water phase.

**2] Preparation of o/w emulsion creams:**

The oil-soluble components and emulsifier are combined in one beaker and heated in a water bath at 75°C. In a separate beaker, water, preservatives, and water-soluble components are also heated at 75°C. Once heated, the oil phase is transferred to a mortar and pestle, and the water phase is gradually added and mixed until a clicking sound is heard. Finally, after the temperature has cooled, perfuming agents and/or additional preservatives are incorporated. It is important to note that in this formulation, the water content will exceed that of the oil.

## WOUND AND WOUND HEALING PROCESS:

Wounds are characterized as the disruption or damage to the cellular and anatomical integrity of the deep skin tissue or living tissues. They can arise from various sources such as physical, chemical, thermal, viral, microbial, violence, or immunological trauma to the skin surface. These wounds not only have a profound impact on the patient's physical and emotional well-being but also impose significant financial burdens, as the resulting scars may persist throughout the patient's lifetime. In general, wounds are referred to as physical injuries that cause the skin to open or break. They can be classified based on the method of infliction and the causative agent involved. [22-28]

1) Open wound.

a) Sharp cut.

b) Laceration.

c) Abrasion.

d) Avulsion.

e) Crush wound.

f) Punctured wound.

g) Bite wound.

h) Burn wound.

2) Closed wound: contusion, closed fracture, etc.

The process of cell contraction, movement, and re-adhesion after skin injury or trauma is known as wound healing. This intricate process involves platelet aggregation, blood clotting, fibrin formation, an inflammatory response to damage, changes in ground substances, angiogenesis, and re-epithelialization. [29-30] The process of healing remains incomplete until the damaged surface is firmly mended by collagen and ultimately culminates in the formation of scars. [31-32] The presence of free radicals can impede the process of wound healing and cause damage to the surrounding skin tissues. Various factors, including infections, nutrition, drugs, hormones, type and location of the wound, and certain disease conditions, can also affect the process of wound healing. [33] In India, for centuries, individuals have utilized natural products derived from plants and animals to treat wounds, as instructed in the widely practiced Indian medicinal system known as Ayurveda. Natural products have been employed for centuries in various regions of the world, and they are gaining significance as an alternative medicine due to their relatively minimal adverse effects. Consequently, scientific research is being conducted on natural/traditional medicine to enhance human health. These products are administered directly in their crude or raw form to address chronic illnesses. [34-37]

**Table: Examples of some plants currently investigated for wound-healing applications.**

| HERBS | MAIN CONSTITUENT | PHYSICAL FORM AND ADMINISTRATION ROUTES | LABORATORIAL AND CLINICAL EVIDENCE |
|---|---|---|---|
| Aloe Vera | Soluble sugar, no starch polysaccharides, glycoproteins and antiseptic agent | Forms: solutions, cream, mucilage, gels and dressing Routes: topical and oral. | Anti-inflammatory and antimicrobial activity; stimulate cell proliferation |
| Hippophaerhamnoids (sea buckthorn) | Flavonoids (e.g. quercietin, | Forms: aqueous leaf extract, seed oil | Antioxidant and anti-inflammatory activity; |

| | | | |
|---|---|---|---|
| | isorhamnetin), vitamins (C, E, K), tennis , organic acid, triterpines, glycerides of palmitic, steric, oleic acid and amino acids. | Routes: topical and oral | stimulate the healing process; improve wound contraction epithelialization. |
| Angelica sinensis | Essintial oils and water soluble ingredients; ferulic acid is the main active constituents. | Forms: ethanol extract, ferulic acid dissolving DMSO. Routes: (n.a, in vitro test) | Stimulate the proliferation of human skin fibroblast, the secretion of collagen |
| Catharanthus roseus (vinca rosea) | Contains two major classes of active compounds: alkaloids (e.g. vincamine ) and tannis. | Forms: ethanol extract Routes: topical | Antimicrobial activity against pseudomonas aeruginosa and staphylococcus aureus; increase wound strength epithelialization, and wound contraction. |

## Ayurvedic medicines for wound healing:

### 1] Aloe Vera (A. barbadense):

One of the significant herbs in Ayurveda, it possesses a diverse range of applications in various skin conditions including burns, psoriasis, and cold sores. Additionally, it can be utilized to alleviate fever, itching, and inflammation. [38,39]

### 2] Peppermint (Mentha piperita):

Peppermint is a widely utilized herb that comes in various forms. Its oil, when topically applied, produces a refreshing and cooling effect on the skin. Peppermint is commonly used in aromatherapy, bath

preparations, mouthwashes, toothpaste, and topical treatments. It is known to alleviate itching, soothe irritation and inflammation, and promote wound healing. [40,41]

## 1] Turmeric (Curcuma longa):

Turmeric is widely utilized in India as both a spice and a colouring agent. Its numerous medicinal properties include anti-cancer, antidiabetic, antioxidant, anti-inflammatory, antibacterial, antiviral, and wound healing effects. [42,43]

### ❖ Jatropacurcas:

It is recognized for its diverse medicinal properties, encompassing anti-microbial, anti-cancer, anti-HIV, anti-bacterial, and wound healing effects. [44]

### ❖ Honey:

Throughout history, honey has been utilized as a conventional remedy. Its properties as an antioxidant, anti-tumour, anti-inflammatory, anti-microbial, and cardiovascular enhancer have been well-documented. Additionally, honey has been employed as a means of wound dressing and wound healing. Its effectiveness has been demonstrated in the treatment of postoperative infections in both adults and neonates, as well as burns, necrotizing fasciitis, infected and non healing wounds and ulcers, boils, pilonidal sinus, venous ulcer, and diabetic foot ulcers. [45, 46]

### ❖ Marigold (Calendula officinalis):

It is an aromatic herbaceous perennial plant that has a short lifespan. This flower/plant has been utilized for centuries for its ornamental, cosmetic, and medicinal properties. Calendula is considered one of the leading herbs and can be ingested orally. It possesses exceptional antioxidant properties and is renowned for its potent antiviral effects. Additionally, it exhibits anti-inflammatory properties, soothes muscle spasms, promotes the healing of ulcers, wounds, and haemorrhoids, aids in menstruation, contains antimicrobial and antiviral components, and enhances oral health. [47,48]

### ❖ Ghee:

The butter derived from cow milk is said to possess numerous medicinal attributes. It is known for its cooling properties, rejuvenating effects, ability to enhance lustre and beauty, boost memory and stamina, improve intellect, and promote longevity. Additionally, it exhibits antimicrobial, immune stimulant, antioxidant, and hepatoprotective activities. Notably, the healing process facilitated by cow ghee is faster

than that of antibiotics. This is attributed to the presence of various saturated and unsaturated fatty acids in cow ghee, which actively participate in the metabolic processes involved in wound healing. [49, 50]

## Alternative medicines/creams for wound healing:

1] Neoprene

2] Silver Nitrate

3] Silver Sulphadiazine

4] Cetrimide

5] Betadine

### 1] Neoprene:

The composition comprises three antibiotics, namely neomycin sulphate, polymyxin B sulphate, and bacitracin zinc. This topical ointment possesses the ability to effectively address specific skin infections occurring in burns, minor cuts, and wounds. The mechanism of action of these antibiotics involves the eradication of bacteria responsible for the development of such infections.

### 2] Nitrate:

The prescribed topical solution is employed for the treatment of skin wounds and burns as an anti-infective agent, antiseptic, and caustic. The adverse effects of silver nitrate have been scarcely documented in the existing literature. Silver nitrate holds the potential to serve as a cauterizing or sclerosing agent. [51]

### 3] Sulphadiazine:

This medication is administered in conjunction with other forms of treatment to aid in the prevention and treatment of wound infections in individuals suffering from severe burns. The mechanism of action of silver sulphadiazine involves inhibiting the growth of bacteria that could potentially infect an open wound. This action effectively reduces the likelihood of bacterial spread to the surrounding skin or bloodstream, which could lead to a severe blood infection known as sepsis. Silver sulphadiazine falls under the category of solfa antibiotics, belonging to a class of drugs. Specifically, silver sulphadiazine cream is utilized for the prevention and treatment of wound infections in patients with second- and third-degree burns. It is important to note that the use of silver sulphadiazine is contraindicated in premature infants and new-borns within the first two months of life due to the potential for serious adverse effects. [52]

### 4] Soframycin:

The Soframycin skin cream, formulated with a concentration of 1% w/w as per IP, contains Framycetinsulphate as its primary constituent. This dermatological product is specifically designed to effectively treat a wide range of conditions such as wounds, furunculosis, cuts, burns, ulcers, lice, impetigo, otitis externa, scabies, and sycosis barbae. [53]

### 5] Cetrimide:

A blend of various quaternary ammonium salts, including cetrimonium bromide, constitutes an antiseptic that was initially uncovered and formulated by ICI and marketed as Cetavlon. This antiseptic is employed in a concentration of 1-3% for the purpose of sanitizing wounds resulting from roadside accidents.

### 6] Betadine:

The active ingredient in question is Povidone Iodine USP 10% w/w, with an available iodine content of 1%. This particular compound has been shown to possess bactericidal properties against both gram-positive and gram-negative bacteria, making it a highly effective broad-spectrum antiseptic. It is commonly used for the topical treatment and prevention of infection in minor cuts and abrasions, as well as for minor surgical procedures and small areas of burns.

Additionally, Povidone Iodine has been found to be effective in the treatment of mycotic and bacterial skin infections. [54]

## EVALUATION PARAMETER OF CREAMS:

### ❖ Following are the evaluation parameters of creams,

1) Determination of pH
2) Physical appearance
3) Spreadability
4) Saponification value
5) Acid value
6) Viscosity
7) Homogeneity
8) Removal
9) Dye test
10) After feel

11) Irritancy study

12) Accelerated stability study

## 1] Determination of pH:

To determine the pH level of the cream, it is necessary to dilute an appropriate amount of the formulation with a suitable solvent in a beaker and measure it using a standard digital pH meter at room temperature.

## 2] Physical appearance:

The cream's colour, texture, and grading allow for visual observation of its physical characteristics.

## 3] Spreadability:

A sufficient quantity of sample is extracted between two glass slides and a force of 100gm is exerted on the slides for a duration of 5 minutes.

Spread ability can be expressed as, S= m*l/t

Where,

m = weight applied to upper slide.

l = length moved on the glass slide.

t = time taken.

## 4] Saponification value:

The substance was refluxed with 25ml of 0.5 N alcoholic KOH for 30 minutes, followed by the addition of 1ml of phenolphthalein and immediate titration with 0.5N HCl. The reading obtained was noted as 'a'. The same procedure was repeated without the substance under examination, and the reading was noted as 'b'.

Saponification value = (b-a) *28.05/w

Where,

w = weight of substance in gram.

## 5) Acid value:

The dissolution process involved the addition of 10gm of the substance to a precisely measured 50ml mixture comprising equal volumes of alcohol and solvent ether. The resulting solution was then connected to a reflux condenser and gradually heated until the sample was completely dissolved. Following this, 1ml of phenolphthalein was introduced into the solution, which was subsequently titrated with 0.1N NaOH. The titration process continued until a faint pink colour emerged after shaking the solution for a duration of 30 seconds.

## 6] Viscosity:

Brookfield Viscometer is used to determine Viscosity of formulated creams.

## 7] Homogeneity:

By the visual appearance and by touch the formulation was tested for homogeneity.

## 8] Removal:

The evaluation of the creams' removal efficacy was conducted by rinsing the treated area with tap water.

## 9] Dye test:

To determine the type of cream, mix scarlet dye with it and place a drop on a slide. Place a cover slip over it and analyse it using a microscope. If the dispersed globule appears red and the ground is colourless, it is an o/w type of cream. Conversely, if the reverse condition appears, it is a w/o type of

## 10] After feel:

The assessment involved examining the emollient properties, lubrication, and quantity of remaining residue subsequent to the administration of a predetermined quantity of cream.

## 11] Irritancy study:

An area measuring 1 square centimetre should be designated on the dorsal surface of the left hand. The cream should be administered to the designated area and the time should be recorded. If present, irritancy, erythema, and edema should be assessed at regular intervals up to 24 hours and documented.

## 12] Accelerated stability study:

An investigation into the stability of the formulation is carried out in an expedited manner, adhering to the guidelines set forth by the International Council for Harmonisation (ICH). [55]

## Conclusion:

Creams, which are widely accepted by society, are semisolid formulations. The skin, being the most accessible part of the body, is highly susceptible to injuries. When it comes to cuts, burns, and wounds, topical formulations like creams are the preferred choice for treatment. In recent decades, there has been significant growth in research and development for the formulation of pharmaceutical creams specifically for wound healing purposes, due to their evident benefits. As the pharmaceutical field and industry continue to progress, it is certain that pharmaceutical creams will remain an intriguing and attractive area of research for the foreseeable future. In the coming years, more advanced technologies and methods will be employed for the preparation, formulation, and evaluation of creams. Additionally, there is an increasing demand for creams that are based on herbal constituents.

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