

# A Review on Salfanilamide Cream for Antibacterial Infection

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**Abstract:** *Over the last decades the treatment of illness has been accomplished by administering drugs to the human body via various routes namely oral, sublingual, rectal, parental, topical, inhalation etc. Topical delivery can be defined as the application of a drug containing formulation to the skin to directly treat cutaneous disorder or the cutaneous manifestations of a general disease (eg. psoriasis) with the intent of containing the pharmacological or the effect of drug to the surface of the skin or within the skin semisolid formulations in all their diversity dominate the system for topical delivery, but foams, spray, medicated powders, solutions and even medicated adhesive systems are in use.[1].*

**Keywords:** cutaneous disorder

## I. INTRODUCTION

### TOPICAL DRUG DELIVERY

Over the last decades the treatment of illness has been accomplished by administering drugs to the human body via various routes namely oral, sublingual, rectal, parental, topical, inhalation etc. Topical delivery can be defined as the application of a drug containing formulation to the skin to directly treat cutaneous disorder or the cutaneous manifestations of a general disease (eg. psoriasis) with the intent of containing the pharmacological or the effect of drug to the surface of the skin or within the skin semisolid formulations in all their diversity dominate the system for topical delivery, but foams, spray, medicated powders, solutions and even medicated adhesive systems are in use.[1]

### Advantages of topical drug delivery system

- Avoidance of first pass metabolism.
- Convenient and easy to apply.
- Avoid risk.
- Inconveniences of intravenous therapy and of the varied conditions of absorption like pH changes presence of enzymes gastric emptying time etc.
- Achievement of efficacy with lower total daily dosage of drug by continuous drug input.
- Avoid fluctuation of drug levels inter and intra patient variations.
- 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.
- Very slow absorption.
- It can be used only for those drugs which need very small plasma concentration for action.
- Can be used only for drugs which require very small plasma concentration for action Possibility of allergic reactions.
- Drugs of larger particle size not easy to absorb through the skin.[2]

## PHYSIOLOGY OF HUMAN SKIN

### Epidermis

The epidermis is the most superficial layer of the skin and is composed of stratified keratinised squamous epithelium, which varies in thickness in different parts of the body. It is thickest on the palms of the hands and soles of the feet.

There are no blood vessels or nerve endings in the epidermis, but its deeper layers are bathed in interstitial fluid from the dermis, which provides oxygen and other nutrients, and drains away as lymph.

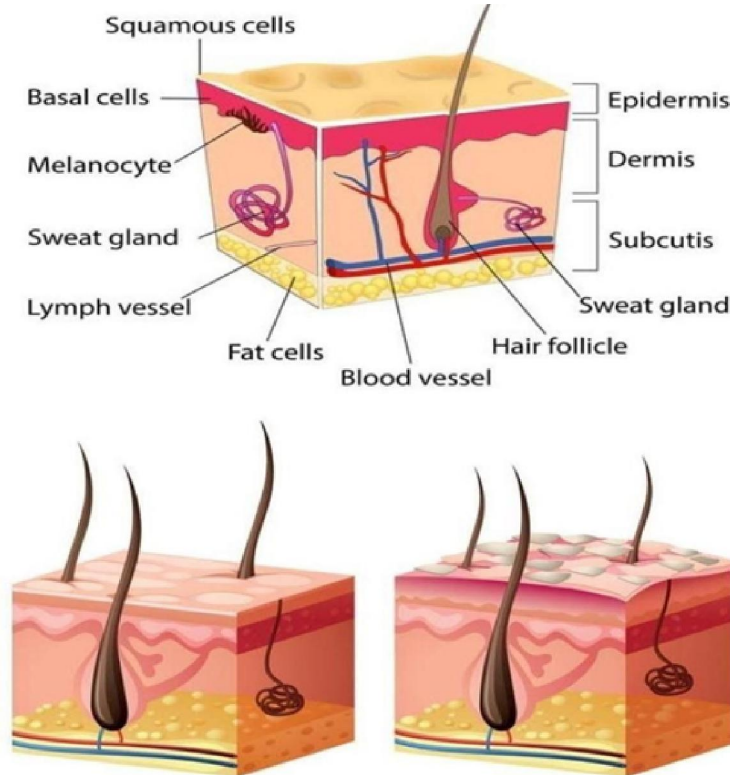


Fig .1.1 structure of skin

### Dermis

The dermis is tough and elastic. It is formed from connective tissue and the matrix contains collagen fibers interlaced with elastic fibers. Rupture of elastic fibers occurs when the skin is overstretched, resulting in permanent striae, or stretch marks, that may be found in pregnancy and obesity. Collagen fibers bind water and give the skin its tensile strength, but as this ability declines with age, wrinkles develop. Fibroblasts, macrophages and mast cells are the main cells found in the dermis. Underlying its deepest layer there is areolar tissue and varying amounts of adipose (fat) tissue.

### Subcutaneous gland

These consist of secretory epithelial cells derived from the same tissue as the hair follicles. They secrete an oily substance, sebum, into the hair follicles and are present in the skin of all parts of the body except the palms of the hands and the soles of the feet. They are most numerous in the skin of the scalp, face, axillae and groins. In regions of transition from one type of superficial epithelium to another, such as lips, eyelids, nipple, labia minora and glans penis, there are sebaceous glands that are independent of hair follicles, secreting sebum directly onto the surface.[3]

### FUNCTIONS OF SKIN:

Skin performs the following functions:

- Protection: An anatomical barrier from pathogens and damage between the internal and external environment in bodily defence, Langerhans cells in the skin are part of the adaptive immune system.
- Sensation: Contains a variety of nerve endings that react to heat and cold, touch, pressure, vibration, and tissue injury, see somatosensory system and haptics.

- Heat regulation: The skin contains a blood supply far greater than its requirements which allows precise control of energy loss by radiation, convection and conduction. Dilated blood vessels increase perfusion and heat loss, while constricted vessels greatly reduce cutaneous blood flow and conserve heat.
- Control of evaporation: The skin provides a relatively dry and semi-impermeable barrier to fluid loss. Loss of this function contributes to the massive fluid loss in burns.
- Aesthetics and communication: Others see our skin and can assess our mood, physical state and attractiveness.
- Storage and synthesis: Acts as a storage centre for lipids and water, as well as a means of synthesis of vitamin D by action of UV on certain parts of the skin.
- Water resistance: The skin acts as a water resistant barrier so essential nutrients aren't washed out of the body.

## **DISEASES OF SKIN**

### **Vitiligo:**

Vitiligo is a condition in which areas of skin lose their normal pigment and so become white. It is common, and affects about 1% of the world's population. The pigment that gives your skin its normal colour is melanin, which is made by cells known as melanocytes.

### **Scabies:**

Scabies is a common and very itchy skin condition caused by human scabies mites. It can affect people of any age but is most common in the young and the elderly. The mites that cause scabies are tiny parasites, smaller than a pinhead. The rash of scabies is a mixture of scratch marks and red scaly areas; later it can become infected and develop small pus spots.

### **Rosacea:**

Rosacea is a common rash, found on the central part of the face, usually of a middle aged person. A tendency to flush easily is followed by persistent redness on the cheeks, chin, forehead and nose. The cause of rosacea is not fully understood, but many think that the defect lies in the blood vessels in the skin of the face, which dilate too easily.

### **Psoriasis:**

Psoriasis is a common skin problem affecting about 2% of the population. It occurs equally in men and women, at any age, and tends to come and go unpredictably. It is not infectious, and does not scar the skin. The skin is a complex organ made up of several different layers.

### **Melanoma:**

Cutaneous malignant melanoma is a cancer of the pigment cells of the skin. If it is treated early, the outlook is usually good. It is not contagious. The word 'melanoma' comes from the Greek word 'melas', meaning black. Melanin is the dark pigment that gives the skin its natural colour.

### **Eczema (Atopic Eczema) :**

Atopic eczema is an inflammatory condition of the skin. Atopic is the term used to describe conditions such as eczema, asthma, seasonal rhinitis and hay fever, which often have a genetic basis. Eczema is the term used to describe changes in the upper layer of the skin that include redness, blistering, oozing, crusting, scaling, thickening and sometimes pigmentation.

## **CREAMS**

Creams are the topical preparations which can be applied on the skin. Creams are defined as "viscous liquid or semi-solid emulsions of either the oil-in-water or water-in-oil type" dosage forms whose consistency varies by oil and water. Creams are used for cosmetic purposes such as cleansing, beautifying, improving appearances, protective or for therapeutic function. These topical formulations are used for the localized effect for the delivery of the drug into the underlying layer of the skin or the mucous membrane. These products are designed to be used topically for the better

site specific delivery of the drug into the skin for skin disorders. Creams are considered as a pharmaceutical product as they are prepared based on techniques developed in the pharmaceutical industry; unmediated and medicated creams are highly used for the treatment of various skin conditions or dermatomes. Creams can be ayurvedic, herbal or allopathic which are used by people according to their needs for their skin conditions. They contain one or more drugs substances dissolved or dispersed in a suitable base. Creams may be classified as o/w or w/o type of emulsion on the basis of phases. The term 'cream' has been traditionally applied to semisolid formulated as either water-in-oil (e.g.: cold cream) or oil-in water (e.g.: vanishing cream). [4]

### **TYPES OF SKIN CREAMS**

They are divided into two types: Oil-in-Water (O/W) creams which are composed of small droplets of oil dispersed in a continuous phase, and an emulsion in which the oil is dispersed as droplets throughout the aqueous phase is termed an oil-in-water (O/W) emulsion Water-in-Oil (W/O) creams which are composed of small droplets of water dispersed in a continuous oily phase. When water is the dispersed phase and oil is the dispersion medium, the emulsion is of the water-in-oil (W/O) type.

### **CLASSIFICATION OF CREAMS**

All the skin creams can be classified on different basis:

- According to function, e.g. cleansing, foundation, massage, etc.
- According to characteristics properties, e.g. cold creams, vanishing creams, etc.
- According to the nature or type of emulsion.

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

- Make-up cream (o/w emulsion): Vanishing creams, Foundation creams.
- Cleansing cream, cleansing milk, Cleansing lotion (w/o emulsion)
- Winter cream (w/o emulsion): Cold cream or moisturizing creams.
- All-purpose cream and general creams.
- Night cream and Massage creams.
- Skin Protective cream.
- Hand and body creams. [5-7]

### **Aim and objective**

Aim: "Formulation & Evaluation of 15% Sulphanilamide cream for antibacterial infection or burning injury and UV analysis of sulphanilamide drug"

### **Objectives:**

The objective of present study is;

- To formulate the topical antibacterial cream.
- To evaluate the Sulphanilamide cream.
- Topical route is more suitable for bacterial infection.
- The main aim of our research was to develop antibacterial cream formulation.
- Consisting of Sulphanilamide cream for treatment of antibacterial infection and burns.

### **NEED OF STUDY**

The topical drug delivery systems designed to have systemic effects appears to be beneficial for a number of drugs on account of several advantages over conventional dosage forms routes of drug administration. The drug sulphanilamide is bacteriostatic antibiotic with broad spectrum against the gram positive and gram negative microbes. Which can be used topically to cure the disease of skin like bacterial infection, prevention infectious burns, etc.

**PLAN OF WORK**

Literature Review.

Selection & Procurement of drug. Selection & Procurement of excipient. Material and Instruments.

Preformulation study.

- Organoleptic properties
- Melting point
- Solubility study

Identification and Characterization of drug

- Absorption Maxima ( $\lambda_{max}$ ) Calibration curve

Formulation of Topical cream

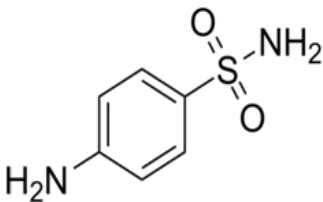
Evaluation of Cream

- Visual appearance
- Determination of Viscosity
- Determination of pH
- Primary skin irritation test
- Spreadability

**DRUG PROFILE**

**Drug Profile:**

**Sulphanilamide**

Parameter	Description
Structure	
IUPAC Name	4- Aminobenzenesulfonamide
Molecular formula	C <sub>6</sub> H <sub>8</sub> N <sub>2</sub> O <sub>2</sub> S
Molecular weight	172.21
Color	White
Nature	Crystalline solid
Category	Anti bacterial
Solubility	Soluble in water
Half life	17 hours
LogP	-0.62
Pka	10.6
Melting point	165.5C
Dose	2gm to 3gm/day Adult dose
Mechanism of Action	As a sulphonamide antibiotic, sulphanilamide functions by competitively inhibiting (that is, by acting as a substrate analogue) enzymatic reactions involving para amino benzoic acid(PABA). Specifically, it competitively inhibitingthe enzyme. Dihydrofolate synthesises PABA is needed in enzymatic reactions that produce folic acid which acts as a Coenzyme in the synthesis of Purine and pyrimidine. Mammals do not synthesise their own folic acid so are unaffected by PABA inhibitors, which selectively kill

	bacteria. However, this effect can be reversed by adding the end products of one-carbon transfer reactions, such as thymidine, purines, methionine, and serine. PABA can also reverse the effects of sulfonamides.
Pharmacodynamics	Sulphanilamide is a competitive inhibitor of bacterial enzyme dihydropteroatesynthetase. This enzyme normally uses para-aminobenzoic acid (PABA) for synthesizing the necessary folic acid. The inhibited reaction is normally necessary in these organisms for the synthesis of folic acid.

Table Sulphanilamide

## II. LITERATURE REVIEW

**Mohammad Al Sorkhy, et al (2020)** :In 1935 the active form of Prontosil was identified as a chemical called sulfanilamide, a substance that was highly effective against Gram- positive bacterial species. Sulfanilamide soon became useful to soldiers in World War II for treating infected wounds.

Sulphanilamide became the first broad-spectrum synthetic agent of a group called sulphonamides. This group of drugs has a bacteriostatic effect, disrupting the metabolism of Gram-positive and Gram-negative bacterial cells by preventing the synthesis of folic acid— an important growth factor used in the synthesis of nucleic acids. Folic acid is produced by enzymatic joining of three components, one of which is para-aminobenzoic acid (PABA)—a molecule similar in structure to a sulphonamide called sulfamethoxazole (SMZ). SMZ competes with PABA for the bacterial enzyme's active site. This competitive inhibition ultimately prevents the synthesis of nucleic acids thereby preventing DNA replication. However, mutations in some bacterial species have now emerged, allowing them to absorb folic acid from extracellular sources and making them resistant to sulfonamides (Griffith et al. 2018).

**Amber Giles et.al (2019):** As one of the earliest developed antimicrobial classes, sulfonamides remain important therapeutic options for the empiric and definitive treatment of various infectious diseases. In the general population, approximately 3–8% of patients are reported to experience a sulfonamide allergy. Sulfonamide allergies can result in various physical manifestations; however, rash is reported as the most frequently observed. In patients with human immunodeficiency virus (HIV), dermatologic reactions to sulfonamide antimicrobial agents occur 10 to 20 times more frequently compared to immunocompetent patients.

**Anton C. de Groot in Monographs in Contact Allergy, 2021**

Sulfanilamide is a short-acting sulfonamide antibiotic. It is bacteriostatic against most gram- positive and many gram-negative organisms, but many strains of an individual species may be resistant. Sulfanilamide competes with p-aminobenzoic acid (PABA) for the bacterial enzyme dihydropteroate synthase, thereby preventing the incorporation of PABA into dihydrofolic acid, the immediate precursor of folic acid. This leads to an inhibition of bacterial folic acid synthesis and de novo synthesis of purines and pyrimidines, ultimately resulting in cell growth arrest and cell death. Sulfanilamide is used in vaginal cream for the treatment of vulvovaginitis caused by *Candida albicans*. The active agent sulfanilamide is present in a specially compounded base buffered to the pH (about 4.8) of the normal vagina to encourage the presence of the normally occurring Döderlein's bacilli in the vagina (1). In Belgium (and probably other countries), it is also available in an ointment for wound treatment.

**Muhamad Mustafa, Jean-Yves Winum(2022)**

The first 'sulfa drugs' used as antibacterial compounds and exemplified by Prontosyl discovery in 1932 and its metabolite the sulfanilamide, the versatility of sulfa compounds as drugs has been demonstrated in all classes of therapeutic agents ranging from antivirals, antibacterial, antifungals, antiparasites and topically used for healing burns, skin infections, etc. The introduction of compounds with special properties such as high or low solubility and prolonged duration of action . It is as safer and more active antibacterial agent .

**Claudiu T. Supuran, Clemente Capasso(2020)**

Sulfonamides, together with the inorganic anions, are the most investigated CA inhibitors (CAIs). Domagk discovered the antimicrobial sulfonamides in 1935 , and they were the first antimicrobial drugs to be widely used in clinical settings. The first sulfonamide showing effective antibacterial activity was Prontosil, a sulfanilamide prodrug, the last

compound being isosteric/isostructural with p-aminobenzoic acid (PABA), the substrate of dihydropteroate synthase (DHPS). In the following years after sulfanilamide was shown to be an effective antibacterial agent, a range of analogs constituting the so-called sulfa drug class of antibacterials entered into clinical use, and many of these compounds are still widely used, despite significant drug resistance problems.

**V K Tiwari. Indian J Plast Surg. 2022 May.**

Management of burn injury has always been the domain of burn specialists. Since ancient time, local and systemic remedies have been advised for burn wound dressing and burn scar prevention. Management of burn wound inflicted by the different physical and chemical agents. Antimicrobial creams and other dressing agents used for traumatic wounds are ineffective in deep burns with eschar. The subeschar plane harbours the micro-organisms and many of these agents are not able to penetrate the eschar. Even after complete epithelisation of burn wound, remodelling phase is prolonged

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