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Original Article

Development and Evaluation of Herbal Screen Cream for UV Protection

Amruta Vispute*, Rohini Jadhav

Department of Pharmacognosy, Aditya College of Pharmacy; Nalwandi Rd, Vipra Nagar, Beed

ABSTRACT

This research focuses on Medicinal plants used in treatment of Skin damage/Diseases caused by Harmful Sun Rays. The exposure of Skin to UV radiations has a destructive effect on Keratinocytes by causing DNA Damage that can subsequently lead to cause Cancer, Melasma Edema, Hyperpigmentation, Photoaging , Weaking of Immune system and Melanoma. The topical application of sunscreens (and the avoidance of extreme exposure to sun rays) is worldwide recognized as the best strategy to avoid sunburn and Oedema. Sunscreen agents are proposed for Sun protection because of their ability to block UV-induce Sunburns. It helps to reduce Harmful effects of the Sun such as Premature Skin Aging and skin Cancer. Sunscreen defence mechanism to prevent against harmful UV-Radiation from sun. Its function is based on its ability to Absorbs, Reflect on Scatter the Sun Rays.

Keywords: Antioxidant, Photoaging, Hyperpigmentation, Sunburns, Peroxidation

INTRODUCTION

The skin uses sunlight to help manufacture vitamin D, which is important for normal bone formation. But there's a downside. The sun's ultraviolet light can cause major damage to the skin. The outer layer of the skin has cells that contain the pigment melanin. Melanin protects skin from the sun's ultraviolet rays. These can burn the skin and reduce its elasticity, leading to premature Aging. People tan because sunlight causes the skin to produce more melanin and darken. The tan fades when new cells move to the surface and the tanned cells are sloughed off. Some sunlight can be good as long as you have proper protection from overexposure. But too much ultraviolet, or UV, exposure can cause sunburn. The UV rays penetrate outer skin layers and hit the deeper layers of the skin, where they can damage or kill skin cells. Herbs have been used in medicines and cosmetics from centuries. Their potential to treat different skin diseases, to adorn and improve the skin appearance is well- known. As ultraviolet (UV) radiation can cause sunburns, wrinkles, lower immunity against infections, premature aging, and cancer, there is permanent need for protection from UV radiation and prevention from their side effects. Herbs and herbal preparations have a high potential due to their antioxidant activity, primarily. Antioxidants such as vitamins (vitamin C, vitamin E), flavonoids, and phenolic acids play the main role in fighting against free radical species that are the main cause of numerous negative skin changes. Although isolated plant compounds have a high potential in protection of the skin, whole herbs extracts showed better potential due to their complex composition. Cactus has antioxidants that are essential for your skin. These antioxidants protect your skin from free radicals. Cactus also has vitamin K which nourishes your skin. Making it a part of your skincare routine also helps in treating premature ageing. It reduces the appearance of ageing signs like wrinkles and fine lines. This plant is also known to treat skin problems like sunburn and pigmentation. Cactus has properties which help in lightening the skin. Cactus has a lot of water content and this is why it is great for your skin. Using cactus on your skin helps in hydration and keeps your skin moisturised. Cactus oil contains antibacterial properties which can heal acne prone skin also Cactus seed oil, which is popular for its anti-ageing properties. The gel from aloe is believed to stimulate skin and assist in new cell growth. Coconut oil resists 30% of UV rays, while sesame, peanut, olive, and cottonseed oils block out about 20%. Traditional use of plant in medication or

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beautification is the basis for researches and making new trends in cosmetics. Shea Butter (Vitellariaparadoxa) is derived from the fat of the shea nut. The shea tree is native to the savannahs of Africa. Shea butter melts at body temperature and absorbs rapidly into the skin without leaving a greasy feeling. It contains the antioxidants, vitamins A and E both of which enhances skin cell regeneration and promote blood circulation below the skin‟s surface. Cinnamic acidin the oil provides vital protection against harmful UV rays.

Effects of UV on skin:

Sun light is mainly of wavelength from UV to visible light. UV is the ultraviolet radiation which is of three divisions such as UVA is of 320-400 nm, UVB is of 290- 320nm and UVC is of 100-290nm. Solar radiation exposure has negative effect over the human skin. UV is most harmful radiation which may cause sunburns and skin cancers Higher exposure of UV radiation may also cause photo irritation; photo aging and carcinogenesis UVA has long wavelength which penetrate and reach the bottom layer of the skin which causes tanning and aging of skin. It is lethal which increase the dermal inflammatory cells and destroy the epidermal antigen activity which is present in the epidermal Langerhans cells. It also accelerates reactive oxygen species (ROS) which causes damage to cell and produces immunosuppressive cytokines. UVB has a short wavelength and enter to the epidermis and small amount into the dermis. It generates pyrimidine dimmers in DNA and damage the structure of DNA. As like UVA it also produces ROS which damages the skin cell and produces immunosuppressive cytokines UVC does not reach the surface of skin. It is blocked completely by the layer of ozone.

How the sun penetrates the different layers of the skin?

UV A rays penetrate the outer layers of the skin (epidermis) reaching the deepest layers (dermis), where several cellular structures will be affected. UV B rays are shorter and more harmful than UVA rays, although the latter reach more depth (dermis).Both UVB rays and UVA are damaging to our skin, being more or less destructive. You have to be very aware when exposing yourself to the Sun, and use maximum protection through creams or supplements, in order to just make use of the benefits which the Sun gives us.

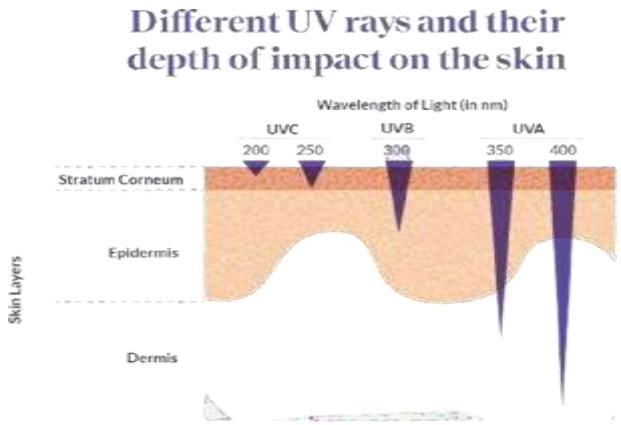

Fig. 1: Different UV rays' impact on skin.

Skin cancer may first appear as a small spot on the skin. Some cancers reach deep into surrounding tissue. They may also spread from the skin to other organs of the body.Each year, more than 2 million people are treated for 2 types of skin cancer: basal cell and squamous cell carcinoma. These cancers are seen in both older and younger people, and they're rarely life-threatening. The best way to protect skin health and prevent skin cancer is to limit sun exposure. Avoid prolonged time in the sun, and choose to be in the shade rather than in direct sunlight. Wear protective clothing and sunglasses, and use sunscreen between 10 a.m. and 4 p.m. Sunscreen is especially important at that time, when the sun's rays are most intense.

Diseases:

1. **Sunburns**

Sunburn is a radiation burn to the skin caused by too much exposure to the sun's ultraviolet (UV) rays or artificial sources such as tanning beds. The biggest risk factors for sunburn is the amount of time the skin is exposed to UV rays, plus the intensity. Many factors such as time of day, medications, ozone depletion, high altitude, clear skies, and skin phototypes influence sunburns. An increase in the number of sunburns someone obtains is directly related to an increase in the risk of skin cancer. Therefore, by fully understanding the cause, treatment, and prevention of sunburns, patients can drastically decrease their risk of skin cancers. This will improve their quality of life. Additionally, by preventing sunburn, patients can reduce the solar effects of aging, which can lead to better cosmetic results.

Etiology:

Sunburn is caused by too much exposure to the ultraviolet radiation from the sun or similar artificial sources such as tanning beds. Many factors contribute to facility and severity of sunburn:

Medications:

Sunburn risk is increased by tetracyclines (especially doxycycline), thiazide diuretics, sulfonamides, fluoroquinolones, nonsteroidal anti-inflammatory drugs, retinoids, and St. John's wort amongst other photosensitizing medication.

Epidemiology:

Type I: Pale white skin, burns easily, does not tan

Type II: White skin, burns easily, tans with difficulty
Type III: White skin, may burn but tans easily

Type IV: Light brown/olive skin, hardly burns, tans easily Type V: Brown skin, usually does not burn, tans easily

Type VI: Black skin, very unlikely to burn, becomes darker with UV radiation exposure.

Treatment/Management

- Avoid the sun to avoid further skin damage
- Use Non-steroidal anti-inflammatories to decrease pain
- Drink plenty of water to avoid dehydration
- Apply topical creams such as aloe vera or hydrocortisone cream while avoiding local anesthetic creams.
- Cool colloidal oatmeal baths may help soothe the skin.

Fig 2: tanning

2. Photoaging

Skin is composed of three layers: the epidermis, the dermis, and subcutaneous tissue. The dermis contains proteins, including collagen, elastin, and other important fibers, that affect the skin's strength and elasticity and are responsible for skin's smooth, youthful appearance. UV radiation damages these important proteins, leading to photoaging skin damage. Photoaging looks like premature aging. Exposure to UV light can cause wrinkles, sagging skin, and an uneven skin tone.

Signs and Symptoms

Photoaging symptoms and signs can include:

Wrinkles, Drooping skin (inelasticity), Dark spots ("age spots"), Broken blood vessels (telangiectasias), A yellowish tint to the skin, Leathery texture to the skin, Mottled pigmentation, Easy bruising, Favre-

Racouchot syndrome (sun-related milia, breakouts, and cysts.

Causes:

Photoaging is caused by UV radiation, which is made up of UVA and UVB rays. In general, UVB rays burn, while UVA rays age the skin, but there is considerable overlap in the skin damage these rays cause. UV A rays have longer wavelengths and can deeply penetrate the dermis. The rays damage existing collagen, which causes increased elastin production. Such abnormal amounts of elastin lead to the production of enzymes known as metalloproteinases that repair damaged collagen. However, these enzymes usually end up causing more harm to the collagen than good by incorrectly restoring the skin. As the skin is exposed to UVA rays on a daily basis, this process keeps repeating, resulting in wrinkles and leathery skin.

Treatment:

For mild to moderate photoaging, treatment may include vitamin A products such as retinol and Retin A. Prescription medications (Retin A and Differin) are much more concentrated than over-the-counter formulations, and likely to be more effective.

- **Photodynamic therapy** is a technique that involves applying a light-sensitizing medicine to the skin. Once the medication has penetrated the skin, the affected area is exposed to a light that activates the medication, promoting collagen growth that gives skin a more youthful, supple appearance.

Intense pulsed light is a light therapy technique that is effective in diminishing the appearance of uneven pigmentation and broken blood vessels over a series of sessions.

- **Laser therapy** can treat a variety of skin issues depending on the wavelength of light applied to the skin. Different wavelengths are used for minimizing blood vessels, treating age spots, reducing wrinkles, and removing hair.

AIM:

Formulation and evaluation of sunscreen cream

OBJECTIVE:

1. The objective of this study is to formulation sunscreen cream that can treat various diseases and is easy to use
2. Sunscreen agents are proposed for Sun protection because of their ability to block UV-induce Sunburns.
3. To show that herbal drug product is safe and it does not have side effects
4. To show the herbal product are cheaper and easily available
5. To understand the quality, safety , efficiency of herbal cream in treatment
6. The objective of study was to formulate and evaluate the sunscreen cream and to study the effect of it.

MATERIALS AND METHODS:

1.Cactus (Optunis Ficus-Indica)

Scientific Name: Cactaceae
Kingdom: Plantae
Divison: Magnoliophyta
Class: Magnoliopsida
Order: Caryophyllales
Family: Cactaceae; Juss

Biological Source

The prickly pear cactus has been used for centuries both as a food source. Opuntia ficus-indica, the Indian or prickly pear, is a species of cactus that has long been a domesticated crop plant grown in agricultural economies throughout arid and semiarid parts of the world. Ficus indica is the most widespread and most commercially important cactus. It is grown primarily as a fruit crop, and also for the vegetable nopales and other uses.

Chemial Constituents: The chemical composition showed considerable amounts of fiber, protein, and minerals. Potassium (K) was the predominant mineral followed by calcium (Ca), magnesium (Mg), sodium (Na), iron (Fe), and zinc (Zn). The main fatty acids of cactus seed oil are Oleic Acid, linoleic acid representating 80-84% of total fatty acids. These were analyzed by gas chromatography.

2. Aloevera (Aloe Vera)

Scientific Name/ Bionomial Name: Aloe Vera
Botanical Name: Aloe Barbadenis Miller
Kingdom: Plantae
Order: Asparagales
Family: Asphodelaceae
Subfamily: Asphodeloideae

Fig.4: Aloe Vera

Biological Source: Aloe is the dried juice collected by incision, from the bases of the leaves of various species of Aloe. Aloe perryi Baker, Aloe vera Linn or Aloe barbadensis Mil and Aloe ferox Miller., belonging to family Liliaceae.

Chemical Constituents

The most important constituents of Aloes are the three isomers of Aloins, Barbaloin, β-barboloin and Isobarbaloin, which constitute the so-called 'crystalline' Aloin, present in the drug at from 10 to 30%. Other constituents are amor-phous Aloin, resin, emodin and Aloe-emodin. Barbaloin is present in all the varieties; it is slightly yellow coloured, bitter, water soluble, crystalline glycoside. Isobarbaloin is a crystalline substance, present in Curacao aloe and in trace amount in Cape aloe and absent in Socotrine and Zanzibar aloe. The chief constituents of Socotrine and Zanzibar aloe are Barbaloin and β-Barbaloin.

3. Walnut (Juglans Regia)

Scientific Name / Bionomial Name: Juglans
Kingdom: Plantae
Class: Angiosperms
Order: Fagales
Family: Fuglandaceae
Genus: Juglans
Species: J. Regia

Fig.5: Walnut

Biological Source: A walnut is the edible seed of a drupe of any tree of the genus Juglans

Chemical Constituents

The chemical composition of walnut shell fibers includes ash (3.4%), lignin (50.3%), hemicellulose (22.4%), and cellulose (23.9%). The total oil content ranged from 62.6 to 70.3% while the crude protein ranged from13.6 to 18.1%. Dietary fiber ranged from 4.2 to 5.2% while the starch content made up no more than 2.8% of the remaining portion of the kernel. Most members of the Walnut family (Juglandaceae) produce a chemical called "juglone" (5 hydroxy-alphanapthoquinone) which occurs naturally in all parts of these plants.

4. Coconut

Kingdom: Plantae
Order: Arecales
Family: Arecaceae
Genus: Cocus
Species: C. Nucifera
Synonyms: Coconut oil

Fig.6: Coconut

Biological Source: Coconut oil is the oil expressed from the dried solid part of endosperm of coconut, Cocos nucifera L., belonging to family Palmae.

Chemical Composition: Coconut obtained from the hard, dried endocarp consists of a mixture of triglycerides of saturated fatty acids. The oil contains about 95% of saturated fatty acids with 8 and 10 carbon atoms. It shows the presence of caprylic acid, 2%; capric acid, 50–80%; lauric acid, 3%; and myristic acid about 1%.

Formulation of Cream:

Formula: Preparation of sunscreen cream:

Sr.no	ingredients	Quantity taken(15gm)
1.	Shea butter/beeswax	2.0gm
2.	Zinc oxide	3.0gm
3.	Cactus seed oil	3ml
4.	Aloe vera gel	1ml
5.	Coconut oil	2ml
6.	Walnut oil	1.2ml
7.	Borax	0.5gm
8.	Liquid paraffin	1ml
9.	Methyl paraben	2ml

Procedure for Preparation of Sunscreen Cream:

- Heat coconut oil and White Bees Wax in borosilicate glass beaker at 75˚C. (Oil phase) and maintain the temperature
- In Another beaker dissolve Borax in liquid paraffin and heat this beaker at 75˚C to dissolve borax to get clear solution. (Aqueous Phase) also add preservative methy paraben in this beaker while heating
- Slowly add Aqueous phase to heated oily phase when they are hot
- Allow the preparation to cool.
- Add active ingredient i.e. cactus seed oil and also add aloe vera gel in the preparation and stir well
- Cool completely before adding zinc oxide in it
- Mix well to make sure zinc oxide is distributed throughout
- Stir well by using stirring machine until it forms creamy consistency
- Add walnut oil for essence and mix it, blend it, creamy formulation will be formed

Formulation Table:

Sr.no	Ingredients	Quantity taken(15gm) F (1)	Quantity taken(15ml) F (2)	Quantity taken(15gm) F (3)
1.	Shea butter/beeswax	2.0gm	3.0gm	2.0gm
2.	Zinc oxide	3.0gm	2.0gm	1.0gm
3.	Cactus seed oil	3ml	4ml	5ml
4.	Aloe vera gel	1ml	2ml	3ml
5.	Coconut oil	2ml	1ml	2ml
6.	Walnut oil	1.2ml	1ml	2.4ml
7.	Borax	0.5gm	1gm	0.8gm
8.	Liquid paraffin	1ml	2ml	3ml
9.	Methyl paraben	2ml	1ml	2ml

Evaluation of Cream: -

1. **Physical Evaluation:**

- **color**: White, off-white color.
- **odor:** aromatic.
- **texture:** smooth.
- **state:** semi-solid.

2. **Irritancy:** mark the area (1cm) on left hand dorsal surface. Applied on that area and time was noted. Then checked irritancy.

3. **Wash Ability**: A small amount of cream was applied on hand and wash with tapped water.

4. **PH:** 0.5 gm cream was taken and dispersed in 50ml distilled water and then PH is measured by using digital PH meter.

5. **Phase Seperation:** prepared cream was kept in closed container at temperature of 25-100˚C away from light. Phase separation was checked after 24h for 30days

6. **Spreadability:** The spreadability was expressed in term of time in second taken by two slides to slip off from the cream, placed in between the two cream, under certain load. Lesser the time taken for seperation of two slides better the spreadability.

Spreadability= mx l/t. Where,
m= std. weight placed over the slide(30g).
L=length of glass slide. (5cm).
t=time taken in seconds.

7. **SPF Factor:**The effectiveness ofsunscreen is usually expreesed by sunscreen protection factor (SPF) ,which is the ratio of uv energy required to produce a minimal erthemal dose in protected skin to unprotected skin .A simple ,rapid and reliable in vitro method of calculating the spf is to screen the absorbance of the product between 290- 320nm at every5nm intervals .SPF can be calculated by applying the following formula known as Mansur equation

• SPF:

spectrophotometric=CF×€EF(wavelength)×I(wavelength)×Abs(wavelength) Where CF=correction factor (10),EE=erythmogenic effect of radiation with wavelength, Abs=spectrophotometric absorbance values at wavelength. The value of EE×I constants

Physiochemical Evaluation of Formulation:

Sr.no.	Physiochemical Parameters	Observations
1.	Colour	White or off white colour
2.	Odour	aromatic
3.	Consistency	Smooth
4.	State	Semi-solid
5.	PH	6.5
6.	Spreadibility	6g.cm/s (good and uniform)
7.	Solubililty	Soluble in many(polar) oils; Also soluble in alcohol
8.	Washibility	Good
9.	No-irritancy	Non-irritant

RESULT AND DISCUSSION:

The cream applied on skin was easily removed by washing with tap water. The prepared cream had found all the property which is actually required for the cream formulation. The pH of the cream was found to be in range of 5-7.5 which is compatiable &good for skin. All the formulations were shown pH nearer to skin required. The prepared formulation produce a uniform distribution of extracts in cream. This was confirmed by visual appearance and by touch. When formulations were kept for long time, it was found that no change in colour of cream. The formulation shows no redness and irritation during irritancy studies. These formulations are safe to use for skin.

CONCLUSION:

- The present work focuses on the potential of cactus seed oil, coconut oil, aloe vera gel from

Herbal pants for sunburn, preamature aging, hyperpigmentation and other purposes.

- The uses of Herbal cream have been increased in many folds in personal care system for better and long-term safety.
- The use of bio active ingredients cactus seed oil, aloevera gel, coconut oil cream influences biological functions of skins and provide constituents necessary for the healing of skin.

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