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Assessment of Decreased Radiodermatitis Sphacelus in Wistar Rats with the Aid of Chamomile - Rosemary Nano Gel

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KEYWORDS
Radiodermatitis, Chamomile, Rosemary, Histological analysis, UV-induced skin damage

ABSTRACT:

Radiodermatitis, a common adverse effect of ultraviolet (UV) radiation, presents a significant challenge in dermatological treatments. This study evaluates the efficacy of a chamomile-rosemary nanogel in mitigating UV-induced radiodermatitis in Wistar rats. A novel nanogel, incorporating the anti-inflammatory properties of chamomile and the antioxidant effects of rosemary, was fabricated and tested for its therapeutic potential. The study employed a controlled UV irradiation model to induce dermatitis in Wistar rats, followed by topical application of the chamomile-rosemary nanogel. Histological analysis, along with clinical observation, demonstrated a marked reduction in sphacelus, inflammation, and tissue damage compared to untreated and conventional treatment groups. The nanogel exhibited superior therapeutic outcomes, evidenced by enhanced skin recovery, reduced lesion severity, and improved overall skin integrity. These findings suggest that the chamomile-rosemary nanogel is a promising and effective treatment for radiodermatitis, offering a novel approach to managing UV-induced skin damage with potential applications in clinical dermatology.

1. Introduction

Radiodermatitis is a skin condition that arises as a side effect of radiation therapy, commonly used in the treatment of cancer. It manifests as redness, dryness, itching, and in severe cases, peeling or ulceration of the skin. This condition occurs due to the damage inflicted on the skin's cells by radiation, disrupting its normal structure and function. Factors such as radiation dose, treatment duration, and individual skin sensitivity can influence the severity of radiodermatitis. Symptoms typically include redness (erythema), dryness, itching, and sensitivity. In more severe cases, persons suffering from radiodermatitis may experience blistering, ulceration, and pain. Traditional treatments often involve topical creams, moisturizers, and sometimes medications to alleviate symptoms and promote healing.

Herbal alternatives for treating dermatitis offer a natural way to manage symptoms, leveraging the therapeutic properties of various plants. Dermatitis, characterized by inflamed, itchy, and irritated skin, can benefit from herbs that have anti-inflammatory, soothing, and healing effects. Using herbal alternatives for treating dermatitis offers a natural approach to managing this often uncomfortable and persistent condition. Herbs can provide anti-inflammatory, soothing, and healing benefits, which can be particularly helpful in alleviating the symptoms of dermatitis, such as redness, itching, and irritation. Chamomile, known for its anti-inflammatory and calming properties, it can reduce skin irritation and promote healing. It is commonly used in topical preparations like creams and ointments or as a soothing agent. Chamomile is widely recognized for its anti-inflammatory, antioxidant, and soothing properties. The active compounds, including bisabolol and chamazulene, contribute to its ability to calm and heal irritated skin. Rosemary, also has strong anti-inflammatory and antimicrobial properties, which make it effective in reducing redness and preventing infections in irritated skin. It also promotes tissue repair. Rosemary extracts in topical products can help accelerate the healing process. Rosemary-infused bathwater can soothe widespread dermatitis symptoms. Its tinctures may be used in a diluted form for topical application or even added to bathwater. Incorporating these herbal alternatives thoughtfully can provide additional relief and support in

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managing radiodermatitis, contributing to improved skin comfort and recovery.

Objectives

The Project's Aim is to Assess the Decrement in Radiation Induced Dermatitis in Wistar Rats with the Aid of Chamomile-Rosemary Nanoge.l

Methods

Collection and Identification: Rosemary and Chamomile herbs were washed with water; shade dried and was brought to minute size. Essential oil in both the herbs were extracted by using steam distillation assembly, with water as a solvent, because essential oils do not get mixed with hydrosol. Around 20 gm of both the chopped herbs were filled in enclosed chamber, where steam was made to pass through the chopped materials. Later, condensation technique was adopted to collect the essential oil.

HPMC and Carbopol were obtained as generous gift sample from Astral sciences, Gujarat. Tween 80 and Transcutol P were bought from Loba chemie, Mumbai, Maharashtra. Triethanolamine were purchased from SD fine chemicals LTD. Mumbai.

Selection of Animals: Animals were procured from the animal house of Onisome Healthcare Pvt. Ltd, approved by the Institutional Animal Ethics Committee (IAEC) and complying the clinical trial protocol, guaranteeing that all methods adhered to ethical standards. Rats were obtained and kept for ninety days in cages made from polypropylene at an Animal House facility. Normal parameters were upheld, including a temperature of 25 ± 2°C, a 12:12 dark–light cycle, and an absolute humidity range of 40–70%. Throughout the trial, rats were given a regular pellet meal and allowed unlimited access to water to ensure that they were healthy and happy.

Phytochemical screening: Phytochemical screening was carried out to identify the presence of alkaloids, carbohydrate, glycoside, flavonoids, triterpenoids, protein, saponins, steroids, tannins, etc. in the ethanolic extract of rosemary and chamomile herb

Preparation of Nanoemulgel :The formulation of a gel incorporating Carbopol 940, HPMC, Transcutol-P, Tween 80, Triethanolamine, and chamomile-rosemary oil.

Induction of radiodermatitis

Initially, in order to evaluate the effectiveness of the artificial rosemary-chamomile nano emulsion gel, radiodermatitis in rats must be induced, and the aforementioned.

Table no. 1 representing distinct grouping of animals

Sr.no	Groups (n=6)	Treatments
1	GROUP I	Control
2	GROUP II	Normal saline
3	GROUP III (C)	Retinoic acid
4	GROUP IV (D)	Fabricated nano emulgel

In the "Ultraviolet ray photodermatitis model" UV rays containing frequencies that vary from 280 to 330 nm were administered to rats in groups B, C, and D in order to mimic radiodermatitis. While Group A had no ultraviolet (UV) radiation at all and served as the control group for the study, the animal's skin experienced allergic reactions after long-term exposure to these harmful UV rays, which resulted in notable changes in a number of epidermal metrics.

Results and Discussion

Chemical Induction of radio dermatitis and after-effects

The part of the rat's skin to be exposed in UV rays were carefully epilated, so as to avoid any unnecessary cuts and bruises, and infliction of unnecessary pain to them. Post exposure, the exposed depicted below mentioned effects and observations. The skin immediately reddens due to dilation of blood vessels, a response to the inflammatory process triggered by UV exposure. Fluid accumulation in the tissues lead to swelling around the exposed area. Rats showed signs of discomfort, such as increased grooming or scratching at the irradiated area. Munro's patches, the large collective accumulator patch were seen, which is popularly called as Munro's patches, resultant to inflammation. Increased Blood Flow: The body increases blood flow to the irradiated area was to initiate repair process

Observation post few hours to few days: The outer layer of the skin began peeling off and development of Lesions were recorded

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Long term observation: Areas of the skin may darken due to increased production of melanin as part of the skin's defense mechanism against UV damage. Skin Aging: exposure to UV radiation accelerated skin aging, characterized by wrinkles, sagging, and loss of elasticity. Increased Risk of Skin Cancer: UV radiation is a known carcinogen and chronic exposure increases the risk of developing skin cancers, including melanoma, squamous cell carcinoma, and basal cell carcinoma.

Histopathological observations

Microscopic examination of dermal tissue exposed to UV radiation reveals characteristic changes such as epidermal thinning, inflammatory cell infiltration, and alterations in dermal architecture.

Assessment of decrement of radiodermatitis post application of fabricated nanoemulgel of rosemary-chamomile herb

Group I (Control - No UV Treatment): This group serves as the baseline control, receiving no UV radiation exposure. Their skin condition provides a reference point for normal skin appearance and physiological parameters.

Group II (Normal Saline Solution - Placebo Treatment): Rats in this group received normal saline solution, which acts as a neutral control to evaluate any non-specific effects unrelated to the nanoemulgel or other active treatments.

Group III (Marketed Retinoic Acid - Positive Control): This group received treatment with marketed retinoic acid, a standard dermatological agent known for its effects on skin regeneration and repair. It serves as a benchmark to compare against the experimental nanoemulgel formulation.

Group IV (Fabricated Nanoemulgel of Rosemary and Chamomile): Rats in this group received the fabricated nanoemulgel containing extracts from rosemary and chamomile herbs. The effectiveness of the fabricated nanoemulgel is compared against the control groups (Group I and II) and the positive control (Group III) based on the reduction of radiodermatitis symptoms and improvement in skin histology and biochemical markers.

Table no. 2 representing assessment of decrement in radiodermatitis

Sr.no	Post exposure to UV (Days)	Control Placebo (B)	Retinoic acid (C)	Nanoemulgel Of rosemary-chamomile herb (D)
1	0	433±5.1	431±5.2	432±5.6
3	8	323±5.9	296±3.2	352±3.5
4	12	300±5.7	155±2.3	295±4.6
6	16	256±4.6	98±7.6	185±8.5
8	20	198±0.2	53±5.9	96±6.3
9	24	156±0.2	13±2.1	21±3.2
% closure of inflamed skin	-	63.97	96.98	95.13

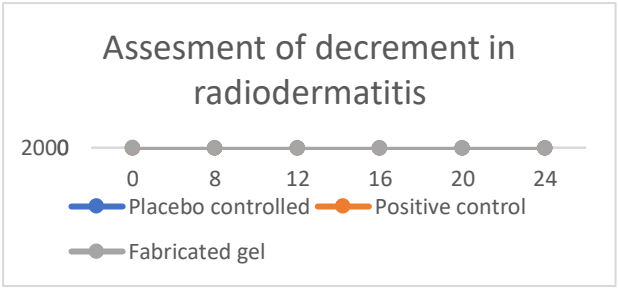

Fig. 01 Graphical assessment of decrement in radiodermatitis

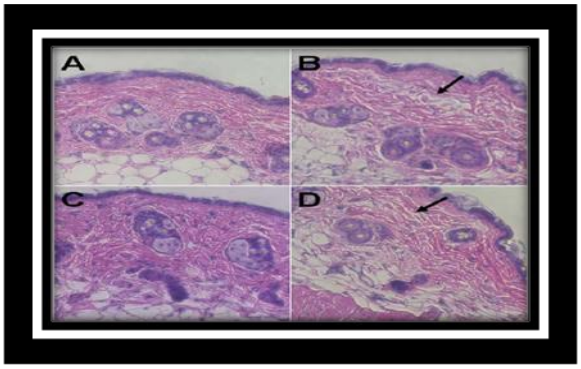

Fig. 02 depicting histological changes occurred during exposure to UV rays, in GROUP I, II, III, IV as A, B, C, D respectively

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When rat skin was depilated from the affected area, histological tests were carried out. Screening of anti-radiodermatitis effect of nanogel was of don with UV induced rats. In the pictorial representations depicted above, it is indicative that picture A is of normal rat not affected by radiations. Picture B denotes inflamed skin of rat with Munro's abscess and inflamed patches with thickened epidermis. As already discussed above, group C were given retinoic acid which is popular anti-radiodermatitis gel, the skin was evolved in a positive manner. No more thickening of epidermis was seen, also less neutrophils came at the site. Now, when optimised gel was applied for group D of rats, over a period of 2 weeks it was seen that, gradually Munros abscess showed decrement in sizes. Also, less neutrophil emerged at site of action. Thickness of epidermis was also a positive sign of optimised formulae.

The study focused on evaluating the effectiveness of a nanoemulgel formulation containing chamomile and rosemary extracts in reducing radiodermatitis severity in Wistar rats. Radiodermatitis, a common side effect of radiation therapy, causes inflammation and damage to the skin. Four groups of rats were included: Group I received no UV treatment (control), Group II received normal saline solution, Group III received marketed retinoic acid (positive control), and Group IV received the fabricated nanoemulgel.

The results showed that the nanoemulgel significantly reduced symptoms of radiodermatitis compared to controls and positively influenced skin histology and biochemical markers.

Overall, the study suggests that the nanoemulgel formulation containing chamomile and rosemary extracts holds promise as a potential therapeutic agent for mitigating radiodermatitis in clinical settings. Further research is warranted to explore its mechanism of action and to validate its efficacy and safety for broader clinical applications in managing skin damage induced by radiation therapy.

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