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RESEARCH

Formulation and Evaluation of Antibacterial Cream containing *Dioscorea Bulbifera Linn*

S. S. Kawathekar *[1]., M. M. Gade [1]., S. V. Kawalwad [1], P. V. Kachare [1] , S. J. Jamadar [1], S. S.Kamble [1]

[1]*Shikshan Prasarak Mandal's College of Pharmacy, Akluj. Tal. Malshiras Dist. Solapur Maharshtra -413101, India.*

**Corresponding author: rxshekhar2011@gmail.com*

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ABSTRACT

The proposed study focuses on formulating and evaluating a topical antimicrobial cream using *Dioscorea bulbifera* (tuber) extracts. Ethanolic extract was incorporated into creams and evaluated for pH, spreadability, viscosity, and stability. Antimicrobial activity was tested using the agar well diffusion method against microbes from natural sources like nail dirt and acne pus, along with standard strains. The ethanolic extract-based cream showed stronger antimicrobial activity, especially against *nail* and *acne bacterial cultured sample*, indicating its greater potential for treating skin infections.

KEYWORDS: *Dioscorea bulbifera*, Antibacterial, herbal Cream,

INTRODUCTION

Medicinal plants continue to serve as a vital foundation for traditional healthcare systems, with historical use dating back thousands of years. Ancient civilizations, such as those in Egypt, India, and China, have long documented the therapeutic properties of botanicals in texts like the Ebers Papyrus, Ayurvedic Samhitas, and Chinese Materia Medica.(1) These systems emphasized the holistic benefits of plant-based remedies for physical and spiritual well-being. In the modern era, nearly 80% of the global population relies on herbal medicine, especially in low and middle-income regions where conventional healthcare may be inaccessible or unaffordable.(2) The increased preference for plant-derived treatments also reflects growing concerns over side effects and resistance associated with synthetic pharmaceuticals.(2)

Among the vast array of medicinal plants, *Dioscorea bulbifera L.*, commonly referred to as air potato, air yam, or bitter yam, stands out due to its widespread use and therapeutic potential.(3) Belonging to the Dioscoreaceae family, this perennial vine thrives in tropical and subtropical climates across Asia, Africa, Australia, and the Americas.(4) Its tubers and aerial bulbils are traditionally consumed in many cultures for their nutritional value, especially in West African diets. Medicinally, various parts of the plant are used to treat ailments such as diabetes, inflammation, infections, thyroid disorders, and even cancer.(5) The pharmacological potential of *D. bulbifera* is attributed to its rich chemical composition, including diosgenin, a bioactive steroidal sapogenin known for its anti-inflammatory, antimicrobial, and anticancer properties.(6-7) (8)

However, increasing demand for *Dioscorea bulbifera*, driven by its medicinal and dietary applications, has led to overharvesting and habitat disturbance, threatening its long-term availability in the wild.(9) Moreover, certain parts of the plant, especially the aerial bulbils, contain toxic compounds that necessitate proper processing before consumption or therapeutic use. These factors highlight the urgent need for sustainable cultivation practices, conservation strategies, and continued scientific research. Strengthening ethnobotanical documentation and advancing pharmacological validation can support safe and effective usage, ensuring that this valuable plant continues to benefit global health while protecting ecological integrity.

EXPERIMENTAL

Microwave-Assisted Extraction of *Dioscorea bulbifera* Tubers
Microwave-assisted extraction of *Dioscorea bulbifera* tubers was performed using both ethanol . For ethanol extraction, 15 g of tuber powder was mixed with 150 mL of ethanol and irradiated in a microwave at 280W for 4 minutes, then cooled. Extract were filtered separately using vacuum filtration to remove plant residues, and the clear filtrates were allowed to evaporate at room temperature for further use.(10)

Formulation of cream Composition

The formulation involved the preparation of a topical cream utilizing both oil and water phase constituents. The table below illustrates the individual components used, their respective amounts, and the phase in which they were incorporated. To prepare a 10 g topical cream, the oil phase was made by heating 0.1 g stearic acid, 0.05 g liquid paraffin, and 0.05 g cetyl alcohol in a water bath at 70–75°C until fully melted and

blended. Simultaneously, the water phase was prepared by heating 0.7 g distilled water, 0.05 g glycerin, 0.02 g triethanolamine, 0.02 g benzyl alcohol, and 0.01 g *Dioscorea bulbifera* extract to the same temperature. The aqueous phase was gradually added to the oil phase with constant stirring to form a uniform emulsion. The mixture was then cooled at room temperature with gentle mixing to avoid air entrapment and finally transferred into a sterile, labeled 10 g container for storage or application.(11)

Evaluation parameters of cream (12)

pH Determination

Table 1: Formulation of cream Composition

Ingredient	Quantity (g)	Phase
Stearic acid	0.1	Oil
Liquid paraffin	0.05	Oil
Cetyl alcohol	0.05	Oil
Glycerin	0.05	Water
Triethanolamine	0.02	Water
Propyl paraben	0.02	Water
Distilled water	0.7	Water
Dioscorea bulbifera extract	0.1	Water

The pH of the prepared formulation was assessed at room temperature using pH indicator strips. This method involved immersing the strip in the cream formulation and comparing the resulting color change with a standard pH chart

Physical Appearance

The physical characteristics of the cream were evaluated visually and by tactile inspection. Parameters such as color, texture, and surface smoothness were assessed for both formulations (F1 and F2).

Spreadability

Spreadability was tested by placing a small quantity of the cream between two glass slides. A 100 g weight was placed on top of the slides for 5 minutes. Spreadability was calculated using the formula: $S = (m \times l) / t$,

where: S = Spreadability, m = weight applied (g), l = length the cream spread (cm), t = time taken (s).

Homogeneity

The cream was inspected visually and manually tested by rubbing a small amount between the fingers to check for uniformity in texture and composition. The presence of lumps, phase separation, or granules was noted.

Washability

To assess washability, the cream was applied to the skin and rinsed off with tap water after a short period. The ease of removal was observed without the use of soap or detergents.

Antimicrobial Assay of *Dioscorea Bulbifera* Cream Using Microbial Isolates from Nail Dirt and Acne Sample:

For the antimicrobial assay of *Dioscorea bulbifera* cream, microbial samples were collected from nail and scalp dirt using sterile swabs, suspended in sterile saline, and vortexed to release the microorganisms. Nutrient agar was prepared, poured into sterile Petri dishes, and after solidification, inoculated by evenly swabbing with the microbial suspensions. Wells of 6–8 mm diameter were made in the agar using a sterile cork borer, ensuring the agar surface remained intact. Into separate wells, standard antimicrobial cream, cream containing aqueous extract of *Dioscorea bulbifera*, and cream with ethanolic extract were introduced. The plates were incubated at 37°C for 24 hours for bacterial samples and at 28–30°C for up to 48 hours for fungal isolates to observe zones of inhibition and assess antimicrobial activity.(13)

RESULT AND DISCUSSION

Microwave-assisted extraction of *Dioscorea bulbifera* tubers

The microwave-assisted extraction of *Dioscorea bulbifera* tubers using ethanol as the solvent was successfully carried out under optimized conditions. A total of 15 g of powdered tuber material was treated with 150 mL of ethanol and subjected to microwave irradiation at 280 W for 4 minutes. After cooling, the mixture was filtered using vacuum filtration to remove plant residues. The resulting clear filtrate was allowed to evaporate at room temperature to obtain the extract.

The extraction yielded a semi-solid residue, with a calculated percentage yield of 5.33% based on the initial weight of the tuber powder. This result demonstrates that ethanol, combined with microwave energy, effectively enhanced the extraction efficiency of bioactive compounds from *Dioscorea bulbifera* in a short time frame. The rapid heating and improved solvent penetration associated with microwave-assisted extraction likely contributed to the improved yield.

Overall, the MAE method using ethanol proved to be an efficient and time-saving approach for extracting phytoconstitu-

ents from *Dioscorea bulbifera* tubers, suggesting its potential for use in large-scale or routine phytochemical extractions.

Evaluation parameters of cream

pH Determination

The pH values of the formulations were consistently measured within the range of 6 to 7. This range falls within the ideal pH window for dermatological preparations, which is close to the natural pH of human skin (approximately 5.5–7). The neutrality of the formulation suggests minimal risk of irritation, dryness, or adverse skin reactions, supporting its safety and compatibility for topical use on sensitive or normal skin types.

Physical Appearance

Both cream formulations (F1 and F2) displayed a uniform white color, indicating the absence of color instability or contamination. The texture was soft, smooth, and free from granules or rough particles. Additionally, the surface appearance was even and glossy, without signs of phase separation or air bubbles. These qualities are indicative of good emulsification and appropriate formulation techniques, which are critical for user appeal and market acceptance.

Spreadability

The cream exhibited good spreadability as reflected by a wide and even spread under the applied weight. The measured spread length indicated that only a minimal amount of effort would be required to apply the product evenly over the skin. This characteristic enhances user satisfaction, facilitates uniform dosing of active ingredients, and ensures effective coverage, especially over larger or irregular skin surfaces.

Homogeneity

The cream demonstrated excellent homogeneity, with no visible clumps, crystals, or phase separation upon inspection. When rubbed between the fingers, the formulation felt consistently smooth and uniform. This suggests that the active and excipient ingredients were well-dispersed throughout the base, which is crucial for ensuring consistent therapeutic efficacy and stability throughout the shelf life.

Washability

The cream was found to be easily washable with plain tap water, leaving no oily or sticky residue on the skin. This high washability reflects the formulation's balanced emulsifying properties and low adherence to the skin. Such behavior is particularly desirable for user convenience, as it facilitates easy removal during routine hygiene practices and reduces potential skin build-up after repeated applications.

Antimicrobial Assay of *Dioscorea Bulbifera* Cream Using Microbial Isolates From Nail Dirt And Acne Sample

The image shows two petri dishes labeled "Acne sample (standard cream)" used to demonstrate the antimicrobial effectiveness of a cream after 24 hours. In both dishes, a clear circular area known as the zone of inhibition is visible around the site where the cream was applied. This zone indicates the region where bacterial growth has been suppressed, highlighting the antibacterial activity of the cream. The presence of this inhibition zone suggests that the standard cream is effective against bacteria commonly found in acne and nail dirt samples. The experiment visually confirms the cream's potential to reduce or prevent bacterial growth, which is crucial for treating skin conditions like acne.

CONCLUSION

The study demonstrated that microwave-assisted extraction

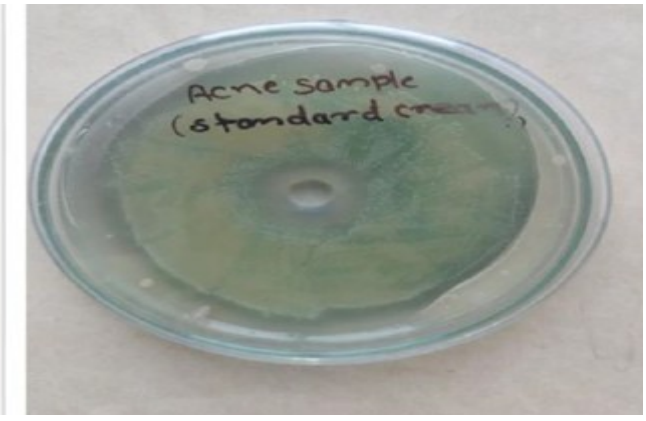

Figure 1: Zone of inhibition against acne sample

Figure 2: Zone of inhibition against nail dirt sample (After 24hrs)

(MAE) of *Dioscorea bulbifera* tubers using ethanol as the solvent is an efficient and time-saving method, yielding 5.33% extract under optimized conditions (280 W for 4 minutes). The resulting cream formulations exhibited desirable properties, including appropriate pH (6–7), smooth texture, good spreadability, homogeneity, and easy washability, indicating their suitability for topical application. Antimicrobial assays showed that while both ethanolic and A9 extract creams exhibited activity against bacteria from nail dirt and acne samples, the A9 extract cream produced significantly larger zones of inhibition after 48 hours, especially against acne-associated microbes. This suggests that the A9 extract cream is more effective in combating bacterial skin infections and supports its potential use in dermatological applications.

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