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Research Article

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THERAPEUTIC PROSPECT OF DRACAENA SANDERIANA: PHARMACOGNOSTIC AUTHENTICATION AND ANTIBACTERIAL EVALUATION

Kavitha Vasudevan[1], Fasna Nargees N.H.[2], Joyal Sebastian[3], Nimmi Thankam Biju[4]

1. Professor and Head, Dept. of Pharmacognosy, 2,3,4 Research Scholars

St. Joseph's College of Pharmacy, Cherthala, Kerala, India

*Corresponding Author Email : *kavithamanoj28@gmail.com*

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ABSTRACT

Dracaena sanderiana, commonly known as lucky bamboo, is an ornamental plant belonging to the family Asparagaceae, with potential medicinal properties that have been acknowledged in traditional medicine. The fresh as well as dried powdered specimens of roots were subjected to basic pharmacognostic examinations like morphological and histological evaluations, qualitative phytochemical investigations, physicochemical evaluations including moisture content determination, ash values and extractive values to unveil the pharmacognostic characteristics this ornamental plant with ethnomedical properties. Macroscopy and Microscopy of the root studied and various features were identified. The phytochemical screening of ethanolic root extract of *Dracaena sanderiana* showed the presence of carbohydrates, proteins, amino acids, saponin, steroids and triterpenoids, glycosides, flavonoids and showed the absence of tannins and alkaloids. Concluding with the evaluation of antibacterial activity of ethanolic root extract of *Dracaena sanderiana*, it is evident that further research is needed to fully understand its potential in combating bacterial infections. The findings suggest a negative activity, yet additional studies are needed to elucidate a more confined result by increasing the concentrations and optimize its application in healthcare and pharmaceutical sectors.

Key Words: *Dracaena sanderiana*, lucky bamboo, antibacterial activity, ash values, extractive values

Introduction

Medicinal plants have played a key role in the development of human culture, serving as a resource for traditional medicine. Herbal products have been crucial in treating, preventing, and controlling the spread of diseases globally. Many modern medicines are derived from natural sources such as plant extracts [1]. In recent years, there has been a growing interest in herbal medicine, with entire plants being used in systems like Ayurveda, Unani, Siddha, and homeopathy for treating diseases, boosting immunity, and providing essential vitamins and antioxidants [2]. Ornamental plants, though primarily valued for their beauty, also serve an important role in traditional and modern medicine. Many ornamental species contain bioactive compounds with therapeutic properties, making them valuable in the treatment and prevention of diseases [3].

Dracaena is a genus of about 200 tree and succulent shrub species, native to Africa, Southern Asia, and Northern Australia. Dracaena species are relevant for both aesthetic and functional purposes in indoor and outdoor environments for various reasons which includes indoor decoration, air purification, symbolism, low maintenance etc. This genus includes notable species like *Dracaena marginata* (Madagascar Dragon Tree), *Dracaena fragrans* (Corn plant), *Dracaena draco* (Dragon's blood tree), *Dracaena reflexa* (Song of India), *Dracaena terniflor*a (Manjakantha) and *Dracaena sanderiana* (Lucky Bamboo). Known for resilience and aesthetic appeal, Dracaena plants are popular in home and office decor. *Dracaena draco*, the first species noted for medicinal uses, is valued for its resin, "dragon's blood," which has wound healing, anti-inflammatory, antimicrobial, gastrointestinal, and antioxidant

properties [4].

Plant profiling [5]

Dracaena sanderiana, commonly known as Lucky Bamboo, is a popular ornamental plant often grown indoors for its attractive appearance and low maintenance requirements.

Classification

·Scientific Name: *Dracaena sanderiana*
·Family: Asparagaceae
·Genus: Dracaena
·Species: *D. sanderiana*

Common names include Lucky bamboo, Sander's dracaena, Ribbon dracaena, Curly bamboo, Chinese water bamboo, Goddess of Mercy's plant, Belgian evergreen plant etc. Synonyms are *Dracaena sanderiana* Mast., *Pleomele sanderiana* (Mast) N.E.Br., *Dracaena poggei* Engl., *Dracaena vanderystii* De Wild, Pleomele poggei (Engl.) N.E. Br.

Dracaena sanderiana, commonly known as lucky bamboo, is a plant with potential medicinal properties that have been acknowledged in traditional medicine. Ethnomedical uses of *Dracaena sanderiana* [6] include:

1.Diarrhoea and Ulcer: In Cihanjuang Village, Indonesia, the plant's boiled leaves are used to treat ulcers and diarrhoea.
2.Skin Care: Extracts from leaves and stems are used as emollients and skin conditioners in cosmetics.
3.Air Purification: Known to remove benzene when grown as a houseplant.
4.Nutritional Value: Contains amino acids, fibre, magnesium, phosphorus, iron, and silica, supporting digestion, blood purification, and cholesterol management.
5.Antioxidant and Hydration: Protects skin from environmental stressors, improves moisture retention, and strengthens the skin barrier.
6.Anti-inflammatory: Contains flavonoids, phenolic acids, and terpenoids that reduce inflammation.
7.Edible Shoots: Consumed in Chinese cuisine.

Despite its traditional medicinal uses, *Dracaena sanderiana* remains underexplored in pharmacognostical and pharmacological research. This study aims to bridge this gap by investigating the plant's pharmacognostic characteristics, preliminary phytochemical composition, Physiochemical parameters and antimicrobial activity, thereby paving the way for its potential use in modern medicine.

Materials and methods

Collection and Authentication of Plant materials

Dracaena sanderiana plants were collected in February 2024 from Kalamassery, Ernakulam district, Kerala. Following standard protocols, the collected specimens were identified and authenticated by Dr. Sreeja Krishnan, Head of the Department of Botany at Sree Narayana College, Cherthala, Alappuzha, Kerala (Voucher specimen number HS122). The herbarium specimen was prepared and deposited in the herbarium section of Sree Narayana College, Cherthala, Alappuzha for future reference.

Preparation of the sample

Fresh plant materials were thoroughly washed under running water to eliminate surface contaminants and potential toxins. They were then shade-dried to a constant weight to preserve phytoconstituents. Then the plant was anatomically separated into roots and aerial parts. For initial investigation, the roots were selected to assess their pharmacognostic, phytochemical and physiochemical characteristics. Roots were then coarsely ground to powder, passed through sieve 100 mesh sizes and stored in airtight containers for further study. Fresh sample of the roots were prepared for sectioning, while dried powdered roots were reserved for phytochemical and physiochemical analysis.

Fig.1: Dracaena sanderiana

Pharmacognostical studies of the roots of *Dracaena sanderiana*

I.Macroscopy

The organoleptic characters of the roots of *Dracaena sanderiana* like colour, odour and taste in addition to

the macroscopic characters viz, size, shape, texture, surface, fracture was evaluated as per standard WHO guidelines. For the powder form, only colour, odour, and taste were evaluated, following the methods outlined by WHO (2011) and Evans *et al*., (2009) [7,8].

II. Microscopy

Free hand transverse sections of fresh root of the plant *Dracaena sanderiana* were taken. For the T.S of root, thin sections were made directly without any pre-treatment stained using Phloroglucinol - HCl reagent, mounted on a glass slide and observed under a microscope.

III.Powder analysis

A small portion of powdered roots was transferred into the drop of glycerol with the help of a moistened needle, then stirred well to mix uniformly, a cover-glass was placed above, and the overflowing fluid was taken out by a piece of filter paper and observed under the microscope (WHO, 2011). The samples were stained with N/50 iodine to examine starches, 0.1% w/v Phloroglucinol solution with a droplet of Conc. HCl to observe the lignified cells, and 5% $FeCl_3$ in alcohol was used for the observation of tannins (Evans, 2009) [7,8].

Preliminary phytochemical screening

The dried, powdered root (25 g) was extracted with ethanol by reflux for 2 hours. It was concentrated to yield dry residues. It was subjected to preliminary phytochemical screening using standard procedures outlined by Evans (2009) to determine the nature of phytoconstituents content. The phytochemical analysis helps to identify the secondary metabolites present in various parts of the plant [8,9].

Physico-chemical analysis

The physicochemical parameters like moisture content (loss on drying), ash values (total ash, water-soluble ash and acid insoluble ash), extractive values Alcohol soluble extractive value, (Water soluble extractive value and Ether soluble extractive value) were being carried out as per standard procedure [10,11].

Preparation of Extract

The dried, coarsely powdered roots were extracted with ethanol (78.37°C) using the Soxhlet extraction method. Packed into a thimble within the Soxhlet apparatus, the sample was exposed to heated ethanol vapours that condensed and percolated through the material, dissolving its constituents. After each cycle, the solvent returned to the distillation flask via a siphon. This exhaustive extraction continued for at least 10 cycles, until the thimble's extract turned colourless. The final extract was then collected filtered and evaporated to dryness.

Percentage of extract = weight of extract in grams/ weight of sample in grams X100

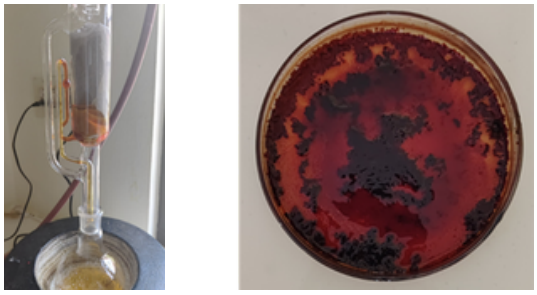

Fig. 2: Extract of Dracaena sanderiana root

Evaluation of Anti-bacterial Activity

A fixed amount of test micro-organisms (*S. aureus*-MTCC No.740 and P. aeruginosa-MTCC No.424) were inoculated in petri dishes containing sterile (Sterilized by autoclaving at 121°C for 20 min.) nutrient agar media. The accurately weighed crude extract was dissolved in DMSO to prepare a stock solution with concentration of 1mg/ml. From these different concentrations viz, (100µg/mL, 250µg/mL and 500µg/mL) were prepared by dilution and added into the 6 mm diameter wells made in inoculated Petri dishes. Amoxicillin (25µg/mL) was used as the standard. The cultures were kept for 4 hours at 2–8°C for the antimicrobial metabolite diffusion and thereafter they were incubated for 24 hours at 37 °C for the growth of test micro-organisms. The zone of inhibition was measured in mm using a zone scale. [12,13].

Results

I.Pharmacognostical evaluation of roots of *Dracaena sanderiana*

1.Organoleptic Evaluation

Morphological and organoleptic observations, utilizing sensory organs, play a crucial role in identifying specific plant species. For immediate documentation,

fundamental characteristics of its roots such as size, shape, colour, odour, taste were assessed. The organoleptic characteristics of root were shown in the table 1.

S. No	Parameters	Results
1	Colour	White to light yellow or orange
2	Shape	Thin and fibrous, extensive branching long and thread-like
3	Size	vary in length,
4	Odour	mild earthy smell
5	Taste	Bland, earthy /slightly bitter flavour.

Table 1: Organoleptic Characters of roots of *D. sanderiana*

2. Microscopic evaluation of Transverse section of roots

a)Transverse section of Root

Transverse section of root shows an outer layer of epidermis, normal but slightly eroded. Epidermis is made up of parenchymatous cells without intercellular space. Root hairs and cutin are present. Epidermis is followed by cortex which is well developed and with many layers. Cells are of oval- shaped. Endodermis present as last layer of cortex which is made up of barrel shaped parenchyma cells. Next is a layer of vascular bundles which are collateral conjoint and closed. Vascular bundles are made up of xylem and phloem. Xylem is with several layers; vessels are thick and lignified. Tracheids are also present. Phloem cells are colourless. Pith is well developed, occupied the central portion. Pith is made up of parenchyma cells with intercellular space. (Figure 3)

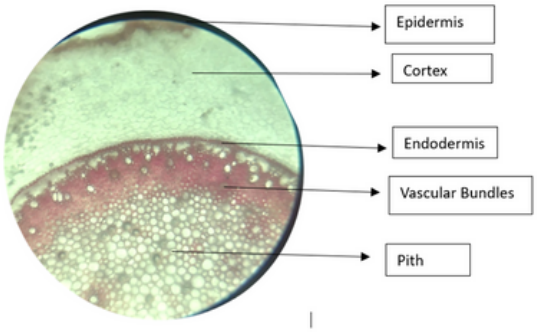

Fig. 3: Transverse section of Roots of *D.sanderiana*

a) Powder microscopy of root powder

Powder characteristics of the root powder were analysed and detected the presence of fragments of cortex, pith, xylem vessels, and root hairs.

3. Physical evaluation of roots of Dracaena sanderiana

The physicochemical parameters like percentage moisture content (loss on drying), ash values (total ash, water- soluble ash and acid insoluble ash) and extractive values (Water soluble extractive value, Alcohol soluble extractive value and Ether soluble extractive values) were determined by following the standard procedures (Anonymous, 2008) and is tabulated in table 2.

S. No	Parameters	Percentage (%)
1	Total ash value	5.39 ± .07
2	Acid insoluble ash value	2.45 ± 0.02
3	Water soluble ash value	1.58 ± 0.04
4	Water soluble extractive value	41.47 ± 0.93
5	Alcohol soluble extractive value	29.16 ± 0.45
6	Ether soluble extractive value	3.23 ± 0.36
7	Percentage moisture content	9.61 ± 0.08

Table 2: Physicochemical parameters of roots of *D. sanderiana*

IV. Preliminary phytochemical screening

The preliminary phytochemical screening of ethanolic extracts of the roots of *Dracaena sanderiana* was carried out and the results obtained are shown in Table 3. The shade dried powder of roots was extracted with ethanol by the Soxhlet method. The extracts were found to contain different phytoconstituents like Carbohydrates, Flavonoids, Saponins, Proteins, Triterpenoids, Steroids, Glycosides, etc and showed the absence of alkaloids

S.No.	Constituent	Name of the Test	Result
1	Carbohydrate	Molisch's test	+
		Fehling's test	+
		Iodine test	+
		Benedict's test	+
2	Alkaloids	Dragendorff's test	-
		Mayer's test	-
		Wagner's test	-
3	Saponins	Foam test	_
		Liebermann-Burchard test	+
4	proteins	Biuret test	+
		Millon's test	+
5	Amino acids	Ninhydrin test	+
6	Steroids and triterpenoids	Salkowski's test	+
		Liebermann-Burchard test	+
7	Glycosides	Borntrager's test	-
		Keller-Kiliani test	+
		Baljet test	-
8	Flavonoids	Shinoda test	-
		Lead acetate test	+
		Sodium hydroxide test	+
9	Tannins	Ferric chloride solution test	-
		Gelatin test	-
		Lead acetate test	-

Table 3: Phytochemical Screening of Root Extract of *D. sanderiana*

Percentage yield

The Ethanolic root extract of *Dracaena sanderiana* was found to have a practical yield of 8.01%w/w

Anti-Bacterial Evaluation of Roots of *Dracaena sanderiana*

Microorganism	Zone of inhibition in mm.			
	Amoxicillin (25µg/mL)	Test (100µg/mL)	Test (250µg/mL)	Test (500µg/mL)
S. aureus-MTCC No.740	25	-	-	-
Aeruginosa-MTCC No.424	23	-	-	-

Table 4: Anti-Bacterial Evaluation of Roots of *D. Sanderiana*

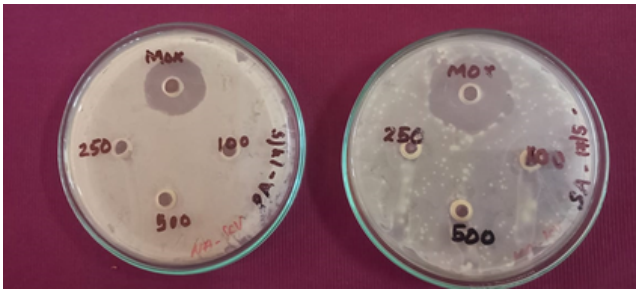

Fig. 4: Screening of anti-bacterial activity

Anti-bacterial activity of the ethanolic root extract of Dracaena sanderiana was assessed in terms of zone of inhibition of bacterial growth. The results were tabulated in Table:4. It was studied in three different concentrations- 100 µg/mL, 250 µg/mL, 500 µg/mL and neither of it possessed antibacterial activity. It was compared with amoxicillin (25µg/mL) as standard.

Conclusion

The current study on the roots of *Dracaena sanderiana* provides foundational data on pharmacognostic standardization, physicochemical properties, phytochemical profile, and elemental composition, marking a first-time investigation of these aspects. The macroscopic and microscopic analysis has uncovered distinctive features critical for the identification and authentication of this plant.

Comprehensive physicochemical parameters and a detailed phytochemical screening have established a profile of key phytoconstituents and toxic elements. This data contributes significantly to the development of a monograph and serves as a reference for researchers, manufacturers, and consumers in ensuring quality control. Additionally, it paves the way for investigating related species that have yet to be thoroughly studied. However, further research is warranted to isolate individual phytochemicals and to conduct *in vitro* screenings on various cell lines, which will deepen our understanding of the pharmacological properties of this rare endemic species.

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References

1. Newman, D. J., & Cragg, G. M. (2020). Natural Products as Sources of New Drugs over the Nearly Four Decades from 01/1981 to 09/2019. Journal of Natural Products, 83(3), 770–803.
2. Patwardhan, B., Warude, D., Pushpangadan, P., & Bhatt, N. (2005). Ayurveda and traditional Chinese medicine: a comparative overview. Evidence-Based Complementary and Alternative Medicine, 2(4), 465–473.
3. Sharifi-Rad, J., et al., (2021), Ornamental plants: A comprehensive review on bioactive compounds and pharmacological aspects. Biomolecules, 11(9), 1274.
4. Deepika Gupta, Bruce Bleakley, Rajinder K. Gupta, Dragon's blood: Botany, chemistry and therapeutic uses, Journal of Ethnopharmacology, Volume 115, Issue 3, 2008, Pages 361-380.
5. Wikipedia contributors. (n.d.). Dracaena sanderiana. In Wikipedia. Retrieved August 17, 2025,fromhttps://en.wikipedia.org/wiki/*Dracaena_sanderiana*
6. Kavitha Vasudevan, Fasna Nargees N H, Joyal Sebastian, Nimmi Thankam Biju *Dracaena sanderiana*: Beyond aesthetics: A review of its medicinal and cultural Significance, World Journal of Biology Pharmacy and Health Sciences, 2024, 19(03), 472–478
7. WHO Quality control methods for herbal materials (2011)
8. Evans, W. (2009) Trease and Evans Pharmacognosy. Elsevier Health Sciences, London, 614.
9. Harborne JB. Phytochemical methods. A guide to modern technique of plant analysis. Chapman and Hill, London. 1992:279
10. Evans WC. Trease and Evans Pharmacognosy. Saunders, London. 2002:95-9. 29.
11. Anonymous. Indian Pharmacopoeia, vol:2, The Indian Pharmacopoeia Commission, Ghaziabad, Govt. of India, Ministry of Health and Family Welfare. 2;78-79
12. Bhalodia N R, Shukla V J. Antibacterial and Antifungal activities from leaf extracts of *Cassia fistula*: An ethnomedical plant. J Adv Pharm Tech Res 2011; 2:104-9.
13. Mounyr Balouiri, Moulay Sadiki, Saad Koraichi, Ibnsouda. Methods for in- vitro evaluating antimicrobial activity: A review. M.Balouiri et al., / Journal of Pharmaceutical Analysis 6 (2016) 71-79.

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Research Article

Journal of Applied and Translational Research in Pharmaceutical Sciences

PHYTOCHEMICAL AND PHARMACOLOGICAL EVALUATION OF ETHANOLIC STEM AND LEAF EXTRACTS OF DENDROPHTHOE FALCATA (L.F.)

Haritha Asokan[1], Thahimon P.A.[2]

1. Research Scholar 2. Professsor & Head, Dept. of Pharmacology, St. Joseph's College of Pharmacy, Cherthala, Kerala, India

*Corresponding author Email: *harithasasokan009@gmail.com*

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ABSTRACT

Peptic ulcer disease results from an imbalance between aggressive luminal factors—including gastric acid, pepsin, ethanol, Helicobacter pylori, and reactive oxygen species—and the mucosal defenses that preserve epithelial integrity. This study investigated the phytochemical composition and pharmacological activities of the ethanolic stem and leaf extract of *Dendrophthoe falcata* (L.f), revealing the presence of flavonoids, tannins, phenolic compounds, glycosides, steroids, and triterpenes, along with high phenolic and flavonoid content, strong antioxidant potential, nitric oxide, and notable antimicrobial activity against *Staphylococcus aureus* and *Escherichia coli.* In vivo ethanol-induced ulcer studies in Wistar rats demonstrated dose-dependent reductions in ulcer index, gastric volume, and total acidity, with increased gastric pH and mucin levels and histological evidence of mucosal protection comparable to omeprazole, supporting the extract's potential as a natural antioxidant, antimicrobial, and antiulcer therapeutic agent.

Key Words: *Dendrophthoe falcata,* Anti-ulcer activity, Antimicrobial activity, Phytochemical analysis.

Introduction

Peptic ulcer disease remains a prevalent gastrointestinal condition attributed to an imbalance between aggressive factors such as hydrochloric acid, pepsin, reactive oxygen species, NSAID exposure, and *Helicobacter pylori* infection, and protective mechanisms including mucin secretion, epithelial restitution, prostaglandin synthesis, and mucosal blood flow. Ethanol-induced mucosal damage, a widely accepted model for evaluating gastroprotective agents, replicates oxidative injury and epithelial erosion leading to acute ulceration [1]. *Dendrophthoe falcata* (L.f.), a hemiparasitic plant belonging to the family Loranthaceae, is traditionally used for treating ulcers, wounds, respiratory diseases, and inflammatory disorders. Phytochemical reports indicate the presence of bioactive compounds including flavonoids, phenolics, terpenoids, tannins, and glycosides, which contribute to antioxidant, antimicrobial, and cytoprotective properties [2]. Given its traditional significance and pharmacological potential, this study aims to systematically evaluate the phytochemical composition, antioxidant activity, antimicrobial effects, and antiulcer efficacy of ethanolic extracts of its stem and leaf.

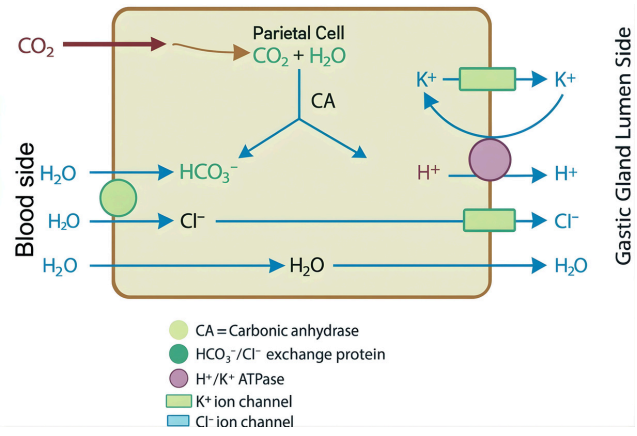

Fig.1: Regulation of HCl secretion

HCl secretion by gastric parietal cells is regulated through multiple mediators and receptors; carbonic anhydrase (CAse), histamine (Hist), acetylcholine (ACh), gastrin, the cholecystokinin receptor (CCK_2), muscarinic receptors (M), histamine H_2 receptors (H_2), prostaglandin receptors (EP_3), the enteric nervous system (ENS), enterochromaffin-like (ECL) cells, and gastrin-releasing peptide (GRP). Each of these factors can either stimulate (+) or inhibit (–) acid secretion depending on their specific mechanism of action [3].

Methodology

Fresh stems and leaves of *Dendrophthoe falcata* were collected, shade-dried, powdered, and extracted using Soxhlet apparatus with ethanol as the solvent. The percentage yield was calculated using standard formulae. Phytochemical screening included tests for carbohydrates, glycosides, flavonoids, phenolics, steroids, tannins, saponins, and triterpenes [4]. Quantitative assays of total phenolic content (TPC) and total flavonoid content (TFC) were conducted using the Folin–Ciocalteu and aluminum chloride methods, respectively. Antioxidant activity was measured using DPPH and nitric oxide scavenging assays. Antimicrobial activity was assessed by agar well diffusion against *Escherichia coli* and *Staphylococcus aureus*. Antiulcer efficacy was examined in ethanol-induced gastric ulcer models in Wistar rats, measuring ulcer index, gastric volume, pH, total acidity, and mucin content, supported by histopathological analysis [5].

Results and Discussion

The phytochemical analysis confirmed the presence of flavonoids, phenols, triterpenes, steroids, and tannins, all of which contribute to biological activity. Quantitative TPC and TFC values supported the presence of strong antioxidant constituents [6].

Antioxidant assays demonstrated effective free-radical scavenging, with DPPH IC50 values significantly lower than several standard herbal extracts. Nitric oxide inhibition further validated the antioxidant capacity of the extract [7]. Antimicrobial evaluation revealed significant inhibition zones against *S. aureus* and *E. coli*, suggesting its spectrum potential. The enhanced activity against Gram-positive bacteria aligns with the phenolic-rich nature of the extract.

In-vivo anti-ulcer activity demonstrated dose-dependent reduction of ulcer index, with 400 mg/kg showing near-complete protection. Increased gastric pH and mucin content, along with decreased acidity,indicate strengthening of mucosal defense [8].

Histopathological analysis showed intact mucosal folds, reduced necrosis, and decreased inflammatory infiltration, highlighting the extract's protective mechanism through antioxidant and cytoprotective pathways [9].

Anti- ulcer activity of EEDF

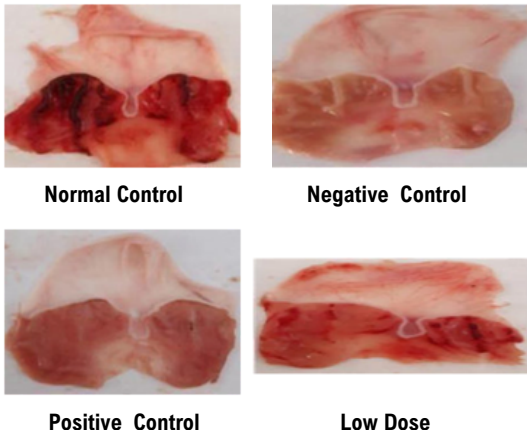

Fig. 2: Anti ulcer activity of EEDF

Conclusion

The present investigation provides comprehensive evidence supporting the therapeutic potential of the ethanolic extract of *Dendrophthoe falcata* stems and leaves in the management of gastric ulceration and microbial infections. The strong antioxidant capacity, reflected by low IC50 values in DPPH and nitric oxide scavenging assays, demonstrates the extract's ability to neutralize reactive oxygen species—key mediators of mucosal damage. The antimicrobial activity against both Gram-positive and Gram-negative bacteria further highlights the spectrum pharmacological profile of the plant.

The significant reduction in ulcer index, restoration of mucosal architecture, improvement in gastric pH, and reduction in total acidity observed in the in vivo ulcer model confirm the extract's cytoprotective and anti-secretory mechanisms. The phytochemical profile, especially the abundance of flavonoids, phenolics, and triterpenoids, likely contributes synergistically to these effects by enhancing mucosal defenses, promoting epithelial regeneration and mitigating inflammatory responses. Overall, the findings validate traditional

medicinal claims associated with *D. falcata* and establish a strong scientific basis for its future development as a natural gastroprotective and antimicrobial agent. Advanced phytochemical investigations, bioactivity-guided fractionation, mechanistic studies, and well-designed clinical trials will be essential to translate these preclinical findings into standardized therapeutic formulations with proven safety and efficacy.

References

1. Sujal C, Chandel A, Bhandari N, Gautam A. A review article on peptic ulcer. Int J Pharm Res Appl. 2024 9(6): 995-1006.
2.Hunt RH, Howden CW, Jones DB, Burget DW, Kerr GD. The correlation between acid suppression and peptic ulcer healing. Scand J Gastroenterol. 1986;21:22-31.
3.Feldman M, Walker P, Green JL, Weingarden K. Life events, stress, and psychosocial factors in men with peptic ulcer disease. Gastroenterology. 1986;91:1370-9.
4.Blair AJ, Feldman M, Barnett C, Walsh JH, Richardson CT. Detailed comparison of basal and food-stimulated gastric acid secretion rates and serum gastrin concentrations in duodenal ulcer patients and normal subjects. J Clin Invest. 1987;79:582-7.
5.Allen A. Structure and function of gastric mucosa. In: Johnson LR, editor. Physiology of the gastrointestinal tract. New York: Raven Press; 1981. p. 617.
6.Goel RK, Bhattacharya SK. Gastroduodenal mucosal defense and mucosal protective agents. Indian J Exp Biol. 1991;29:701-14.
7.Svanes K, Takeachi K, Ito S, Silen W. Effect of luminal pH and nutrient bicarbonate concentration on restitution after gastric surface injury. Surgery. 1983;94:494-500.
8.Clark DC, Brater JC, Johnson AR. Goth's Medical Pharmacology. 13th ed. St. Louis: Mosby Year Book; 1992. p. 507-13.
9.Duggan JM, Duggan AE. The possible causes of the pandemic of peptic ulcer in the late 19th and early 20th century. Med J Aust. 2006;185:667-9.

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Research Article

Journal of Applied and Translational Research in Pharmaceutical Sciences

FORMULATION AND EVALUATION OF AN ANTIFUNGAL LOADED NANOGEL DESIGNED FOR TRANSUNGUAL DRUG DELIVERY

Jayasankar K.R.[1], Boby Johns G.[2]

1. Research Scholar, 2. Professor & Head, Dept. of Pharmaceutics, St. Joseph's College of Pharmacy, Cherthala, Kerala, India

*Corresponding Author Email : *jayasankarkr178@gmail.com*

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ABSTRACT

Transungual drug delivery provides a targeted and non-invasive approach for treating onychomycosis. This study aimed to formulate a Berberine chloride hydrate-loaded nanogel using Poloxamer 407 and evaluate its suitability for transungual antifungal delivery. Various formulations were prepared and characterized through FTIR, DSC, pH measurement, viscosity, spreadability, particle size, entrapment efficiency, and in vitro diffusion studies using a Franz diffusion cell. Among all formulations, F4 exhibited optimal pH (5.57), high entrapment efficiency (56.2 ± 7.6%), viscosity (35,752 cP), and maximum drug release (94.82% after 19 hours). These results suggest that F4 possesses ideal characteristics for effective topical transungual delivery of antifungal agents.

Key Words: Transungual DDS, onychomycosis, nanogels, antifungal agent

Introduction

Onychomycosis is a fungal infection of the nail plate that affects millions globally, causing nail thickening, discoloration, and discomfort [1]. Traditional oral antifungal treatments are often associated with systemic side effects and high recurrence rates. Topical formulations face the challenge of limited nail penetration due to the dense keratinized nail barrier. Transungual delivery enables localized therapy, minimizing systemic exposure while improving patient compliance [2]. Nanogels—hydrophilic, nanosized polymeric networks—offer advantages such as high drug loading, controlled release, and enhanced nail permeation. This study focuses on developing and characterizing a Berberine chloride hydrate-loaded nanogel for efficient transungual antifungal therapy.

Materials and Methods

Nanogels were prepared using Poloxamer 407 as a thermosensitive polymer, chitosan as a stabilizer, and mercaptoethanol as a permeation enhancer. Berberine chloride hydrate served as the active antifungal agent. Different formulations (F1–F5) were optimized based on polymer ratios [3]. Physicochemical characterization included Fourier Transform Infrared Spectroscopy (FTIR) to confirm compatibility, Differential Scanning Calorimetry (DSC) to assess thermal behavior, pH measurement, viscosity testing, spreadability (parallel plate method), and entrapment efficiency determination. In vitro drug release was assessed using the Franz diffusion cell with a bovine hoof membrane as a nail model [4]. Antifungal activity against Candida albicans was determined using agar diffusion assays [5].

Results and Discussion

FTIR spectra confirmed no significant chemical interaction between Berberine chloride hydrate and excipients, ensuring formulation stability. DSC analysis revealed thermal stability up to 350°C, followed by gradual polymer decomposition, characteristic of Poloxamer–chitosan nanogels. Among the five formulations, F4 showed superior performance in all evaluated parameters. The nanogel exhibited optimal pH (5.57), mimicking the physiological pH of the nail surface, ensuring

compatibility and reduced irritation. F4 displayed the highest viscosity (35,752 cP) and entrapment efficiency (56.2 ± 7.6%), indicating strong gel matrix formation and effective drug loading. The spreadability (16.8 g/cm/sec) suggested suitable application consistency. In vitro diffusion studies demonstrated sustained release behavior, with F4 achieving 94.82% cumulative drug release within 19 hours. Scanning Electron Microscopy (SEM) revealed spherical nanogels of 100–200 nm with uniform distribution, supporting efficient permeation through the nail plate. Antifungal testing confirmed that formulation F4 exhibited significant inhibitory zones against Candida albicans compared to other formulations, validating its therapeutic potential.

Ingredients	F1	F2	F3	F4	F5
Berberine chloride hydrate	30 mg (20%)	37.5mg (25%)	45 mg (30%)	52.5mg (35%)	60 mg (40%)
Poloxamer 407	15 mg (10%)	30 mg (20%)	45 mg (30%)	60 mg (40%)	75 mg (50%)
Chitosan	96 mg	73.5mg	51mg	28.5mg	6 mg
Mercapto ethanol	7.5 mg	7.5 mg	7.5 mg	7.5 mg	7.5 mg
Triethanol amine	1.5 mg	1.5 mg	1.5 mg	1.5 mg	1.5 mg

Table 1: Formulation chart

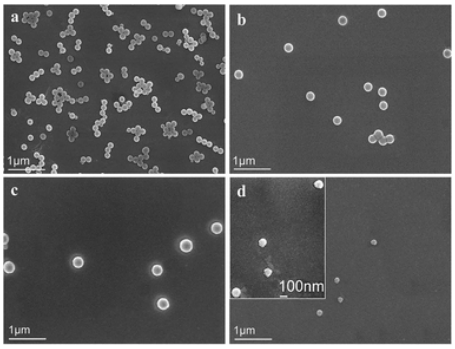

Fig. 1: SEM analysis of F4 formulation

Conclusion

The study successfully formulated a Berberine chloride hydrate-loaded nanogel for transungual antifungal delivery. The optimized formulation (F4) exhibited favorable physicochemical characteristics, superior drug release, and potent antifungal activity. These findings suggest that nanogel-based systems represent a promising approach for enhancing transungual drug delivery in the treatment of onychomycosis. Further studies involving ex vivo and clinical evaluations are recommended to confirm efficacy and patient tolerability.

References

1. Srivastava S, Saha S, Jakhmola V. Nanogel: Types, Methods of Preparation, Limitation, Evaluation and Application—A Systematic Review. Int J Drug Deliv Technol. 2023;13:1631–9.
2. Tanwar H, Sharma M, Ahuja M. Preparation and Evaluation of Berberine Chloride Loaded Poloxamer Gel for Transungual Delivery. Int J Pharm Pharm Sci. 2024;12(3):45–52.
3. Kappes S, Faber T, Nelleßen L, Yesilkaya T, Bock U, Lamprecht A. Improving transungual permeation study design by increased bovine hoof membrane thickness. Pharmaceutics. 2021;13(12):2098.
4. Alam G, Singh MP, Singh A, Vishwakarma DK, Patel R, Srivastava SP. Transungual drug transport: advancement and challenges. J Pharm Res. 2012;5(5):2574–9.
5. Sultana F, Imran-Ul-Haque M, Arafat M, Sharmin S. An overview of nanogel drug delivery system. J Appl Pharm Sci. 2013;3(8):S95–105.

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Research Article

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EFFECTIVENESS OF PATIENT COUNSELLING ON QUALITY OF LIFE IN PATIENTS WITH DIABETES MELLITUS

Jeny Samuel

Professor, Dept. of Pharmacy Practice, St. Joseph's College of Pharmacy, Cherthala, Kerala, India

*Corresponding Author Email : *jenyacademics@gmail.com*

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ABSTRACT

This article explores the role of structured patient counselling in enhancing the quality of life (QoL) of individuals with type 2 diabetes mellitus. Drawing from clinical study data and established theoretical frameworks, the report emphasises how counselling contributes to improved glycaemic control, greater self-management capacity, and positive psychosocial adjustment. The findings strongly support incorporating patient-centred counselling as a routine component of diabetes management to mitigate complications, improve long-term outcomes, and enhance well-being. These outcomes highlight the multifaceted influence of counselling, extending beyond clinical indicators to encompass emotional resilience and social functioning.

Key Words: Diabetes Mellitus,Patient Counselling, Quality of Life, Self-Management, Glycaemic Monitoring

Introduction

Diabetes mellitus remains one of the most pressing global health challenges due to its rising prevalence and complex multisystem complications. Type 2 diabetes occurs predominantly due to impaired insulin secretion, insulin resistance, genetic predisposition, and lifestyle-related risk factors [1]. The chronic nature of diabetes necessitates long-term treatment, continuous monitoring, and sustained behavioural changes, all of which directly influence patient outcomes.

Quality of life has become an essential measure in chronic disease evaluation, reflecting not only clinical outcomes but also emotional, social, and functional well-being. Patient counselling plays a central role in enabling individuals to acquire adequate disease-related knowledge, improve adherence, and develop coping strategies that support self-care and decision-making [2]. The present study investigates the measurable impact of structured counselling interventions delivered to diabetic patients, revealing significant improvements across multiple QoL domains.

Methodology

A quasi-experimental study design was adopted involving two groups—an experimental group that received comprehensive counselling and a control group receiving standard care. Counselling interventions were delivered by trained healthcare professionals and included modules on medication adherence, diet modification, physical activity, glucose monitoring, and psychological support. Both groups underwent pre- and post-intervention assessment using a validated QoL scale comprising four major domains.

Statistical analyses were conducted using paired t-tests to determine intra-group differences and unpaired t-tests for inter-group comparisons. Socio-demographic variables were compared at baseline to ensure homogeneity between the groups, thereby allowing accurate interpretation of post-intervention effects.

Results and Discussion

The findings demonstrated that structured counselling significantly enhanced QoL among the experimental group across all four subscales—health and functioning, social and economic well-being, psychological/spiritual well-being, and family relationships. The most notable improvement occurred in the family subscale, followed closely by the health and functioning domain. Conversely, the control group displayed negligible improvement, with most participants remaining in the slightly dissatisfied category.

The observed outcomes are consistent with earlier studies suggesting that counselling increases patient engagement in self-care, enhances adherence, and strengthens emotional resilience [3,4]. By explaining medication use, lifestyle adjustments, and symptom monitoring, counselling reduces uncertainty and promotes informed participation in treatment.

Furthermore, diabetes management extends beyond clinical interventions to include psychological and familial support. Regular counselling provides a platform for addressing emotional distress, correcting misconceptions, and motivating patients to adopt consistent health-promoting behaviours. Several researchers have emphasised the role of education-based interventions in improving metabolic outcomes and stabilizing glycaemic profiles [5]. The present study reinforces such findings, showing that counselling not only enhances QoL but also strengthens patient autonomy and long-term adherence.

Notably, the improvement in family support suggests that counselling may indirectly strengthen interpersonal relationships by reducing diabetes-related stress, enhancing communication, and enabling families to take an active role in the patient's care.

In addition to the primary findings, the broader implications of counselling in diabetes management deserve further consideration. Chronic diseases such as diabetes impose significant psychological burdens, often manifesting as anxiety, depression, fear of complications, and reduced confidence in disease self-management. Without appropriate guidance, many patients struggle with misconceptions regarding diet, exercise, medication timing, and long-term prognosis [6]. Counselling addresses these challenges through structured education and motivational support.

Another crucial dimension of counselling is its role in empowering patients to interpret their physiological responses. Many individuals fail to recognise the importance of blood glucose monitoring or misinterpret fluctuations. Counselling equips patients to understand the significance of fasting and post-prandial readings, identify patterns, and recognise when medical attention is necessary. Enhanced monitoring behaviour reduces the likelihood of emergency complications and improves long-term glycaemic stability.

Counselling also promotes adherence to pharmacotherapeutic regimens. Medication non-compliance remains a global issue, particularly among diabetic populations where asymptomatic stages lead to treatment neglect. Evidence suggests that behavioural interventions, especially those grounded in concordance models, improve adherence more effectively than instruction-based approaches alone [7]. The present study supports such findings, with significant increases in adherence-associated QoL domains.

Collectively, these insights emphasize the need to institutionalize patient counselling as a fundamental component of diabetes care. Hospitals, clinics, and pharmacies should integrate structured counselling protocols, ensure staff training, and allocate resources to sustain continuous patient education. Ultimately, enhancing patients' QoL requires not only pharmacological optimization but also empowering them with knowledge, confidence, and supportive communication.

Conclusion

The extended findings of this study reaffirm that structured patient counselling substantially improves the quality of life of individuals with type 2 diabetes mellitus. By promoting disease understanding, enhancing adherence, strengthening psychosocial support, and fostering healthier lifestyle patterns, counselling emerges as a critical determinant of therapeutic success. Healthcare systems should prioritize structured counselling as an indispensable component of diabetes management to achieve

component of diabetes management to achieve sustained improvements in patient outcomes.

References

1.Kharroubi AT, Darwish HM. Diabetes mellitus: The epidemic of the century. World J Diabetes. 2015 Jun 25;6(6):850–67.

2.Powers AC. Diabetes Mellitus. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson J, Loscalzo J, editors. Harrison's Principles of Internal Medicine. 18th ed. New York: McGraw-Hill; 2012. Chapter 345.

3.Tong B, Stevenson C. Comorbidity of cardiovascular disease, diabetes and chronic kidney disease in Australia. Canberra: Australian Institute of Health and Welfare; 2007 Aug. Report no.: 12(3). p. 14–29.

4.Nathan DM, Buse JB, Davidson MB, Ferrannini E, Holman RR, Sherwin R, et al. American Diabetes Association: Standards of medical care in diabetes-2008. Diabetes Care. 2008;31(Suppl 1):S12–54.

5.Satpute DA, Kulkarni MD, Karanjekar VD, Dighore PN. Assessment of impact of patient counselling, nutrition and exercise in patients with type 2 diabetes mellitus. Int J PharmTech Res. 2009;1(1):1-21.

.Giani E, Sani M, et al. Impact of new technologies on diabetes care. World J Diabetes. 2015 Jul 25;6(8):999-1004.

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Review Article

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A REVIEW ON THE ANTICANCER PROPERTY OF INDOLE -3- CARBINOL

Lirin Mary M.K. [1], Amal Krishna S[2], Haren Devid Antony[2], Hariprasad M.[2], John Joseph[2]

[1] Assoc. Professor, Department of Pharmaceutical Chemistry

[2] Student Researchers, St Joseph's College of Pharmacy, Cherthala, Kerala, India

*Corresponding Author Email : *liril86@gmail.com*

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ABSTRACT

Cancer remains a leading global cause of mortality, responsible for 8.2 million deaths and projected to reach 13.1 million by 2030, with major risk factors including ionizing radiation, pathogens, and genetic influences, and with common types such as carcinoma, sarcoma, leukemia, lymphoma, myeloma, and cancers of the central nervous system. Although various treatments exist and many anticancer drugs have been developed, particular attention has been given to indole-3-carbinol, a phytochemical derived from glucobrassicin in cruciferous vegetables such as cabbage, cauliflower, and Brussels sprouts, owing to its ability to promote 2-hydroxylation of estrogen, enhance 2-hydroxyestrone synthesis, suppress carcinogenic 16-hydroxylation of estrone, and exhibit additional antioxidant and anti-atherogenic properties. Collectively, these findings indicate that adequate consumption of cruciferous vegetables may help reduce cancer risk.

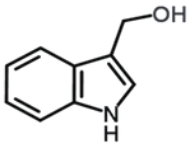
Key Words: Cancer, Indole-3- Carbinol, 2-hydroxylation, Gluco-bracassin

Introduction

Our body is composed of millions of cells, each a self-contained living unit. Each cell coordinates with the others that compose tissues and organs of our body. Normal cells in the body grow and divide for a period of time and then stop growing and dividing thereafter, they only reproduce themselves as necessary to replace defective or dying cells. Cancer occurs when this cellular reproduction process goes out of control [1]. In other words, cancer is a disease characterized by uncontrolled, uncoordinated and undesirable cell growth with the potential to invade or spread to other parts of the body [1],[2]. Unlike normal cell, cancer cells continue to grow and divide for their whole life, replicating into more and more harmful cells.

The abnormal growth and division observed in cancer cells is caused by damage in this cell's DNA. Cellular DNA can become damaged and defective in variety of ways. eg: Environmental factors like exposure to tobacco smoke initiate a chain of events that resultsin cellular DNA defects that lead to cancer. Also defective DNA can be inherited from our parents. As in cellular DNA defects that lead to cancer. Also defective DNA can be inherited from our parents. As cancer cell divide and replicate themselves and they often form in to clump of cancer cells known as tumors. Tumors cause many of the symptoms of cancer by pressuring, crushing and destroying surrounding non-cancerous cells and tissues [3].

Indole-3- crabinol



An indolyl alcohol carrying hydroxyl methyl group at position 3. It is a constituent of cruciferous vegetables and had anti-cancer activity.

Physical Properties

Indole-3-carbinol is a substance found in vegetables such as Broccoli, Brussels, Sprouts, Cabbage,

IUPAC name	1H-Indole-3-methanol
Other names	3-indolylcarbinol;indole-3-methanol;3 hydroxymethylindole;3-indolemathanol; Indole-3-methanol
Chemical formula	C9H9NO
Molar mass	147.18 g\mol
Appearance	Off-White solid
Melting point	96-99degree C (205-210 degree F, 369 to 372 K)
Solubility	Partially soluble in cold water
Storage temp.	2-8 degree C

Table 1: Physical properties

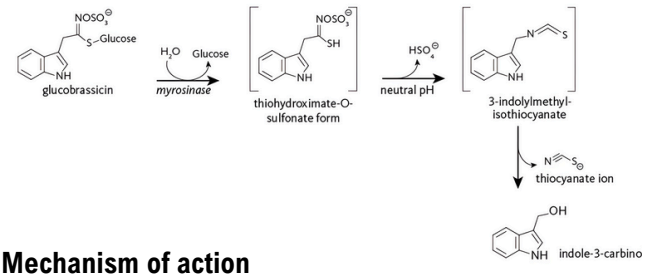
Collards, Cauliflower, Kale, Mustard greens, Turnips and Rutabagas [4]. These vegetables have been researched since the mid 19thcentury on account of their physiological effects on humans and ruminant their physiological effects on humans and ruminants [5]. Two types of Sulphur containing compounds are present in all cruciferous vegetables: the glucosinolates (formerly called thioglucosides) and S-methyl cysteine sulphoxide. I3C is a metabolite of glucosinolate and glucobrassicin, also known as indole-3-glucosinolate [6]. In recent years, this compound has been shown to inhibit human breast and ovarian cancers [7] [8] [9] [10]. The possible anticancer property of I3C was recognized by roman statesman, Cato the Elder who in his treatise on medicine wrote: "if a cancerous ulcer appears upon the breasts, apply a crushed cabbage leaf and it will make it well:" Crushing cabbage leaf would convert Indole-3-glucosinolate to I3C, among other reactions.

Estrogen has been implicated in the etiology of breast and ovarian cancers. A metabolite of estrogen, 16α-hydroxyestrone has been found to have a significant role in the development of viral, carcinogen induced and oncogene-transfected tumors. I3C is thought to inhibit the conversion of estrogen to this compound during hydroxylation by promoting an alternative pathway that produces 2-hydroxyl estrone. The second compound is a weak anti-estrogen and has no tumorigenic effects. In effect I3C inhibits the formation of the "carcinogenic" [4] form of estrogen metabolite, simultaneously depleting the available estrogen pool for its formation, thereby facilitating chemoprevention.

The National Institute of Health (NIH) has reviewed Indole-3-carbinolas possible cancer prevent agent. Indole-3-carbinol is used for breast cancer, colon cancer fibromyalgia, tumors inside the voice box (laryngeal papillomatosis) caused by virus, cervical dysplasia and systemic lupus erythematosus (SLE). Some use Indole-3-carbinol to balance hormone, detoxify intestine and liver and tosupport immune system.

Bio-synthesis of indole-3-carbinol

Glucobrassicin present in cruciferous vegetables is hydrolysed by an enzyme myrosinase and forms every unsuitable molecule like thiohydroxymate-o-sulphonate form and then to 3-indolylmethyl-isothiocyanate. Due to the unstability of the compound formed by the hydrolysis of glucobrassicin, which eventually degrades to form indole-3-carbinol and thiocyanate ion.



Mechanism of action

The estrogen metabolites 16α-hydroxyestrone and 4-hydroxyestrone have been demonstrated to be carcinogens of estrogen. On the other hand, 2-hydroxyestrone has been found to be protective [3]

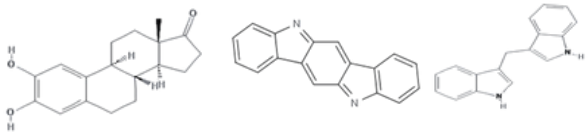
against several types of cancer, including breast cancer. Indole-3-carbinol has been shown to increase the ratio of 2-hydroxy estrone to16α-hydroxyestrone and also inhibit the 4-hydroxylation of estradiol. Indole-3-carbinol increases 2-hydroxilation of estrogens via induction of cytochrome P4501A1 (CYP1A1). In stomach, Indole-3-carbinol converted in to diindolymethane (DIM) and indole carbazole (ICZ) by acid. DIM and CIZ have similar activities regarding estrogen metabolism.

Regarding its possible anticarcinogenic effects, Indole-3-carbinol has been shown to modulate the activities of both phase 1 enzymes, such as cytochromeP4501A, -1A2, -2B1, -2B2, -3A1and –3A2, and phase II enzymes, such as glutathione S-transferase (GST), quinine reductase and uridine glucuronide transferase. Indole-3-carbinol modulates the metabolism of carcinogens, such as benzopyrene, aflatoxin B1 and 4-(methylnitrosoamino)-1-(3-pyridyl)-1-butanone (NNK), Indole-3-carbinol has also been shown to up regulate apoptosis in some cancer cell lines [11].

As mentioned above, indole-3-carbinol induces the synthesis of 2-hydroxyestrone. 2-hydroxyestrone has been found to inhibit the oxidation of low density lipoprotein. This indicates that indole-3-carbinol has indirect antioxidant activity. 2-hydroxyestrone also appears to inhibit smooth muscle proliferation. Inhibition of smooth muscle proliferation and inhibition of the oxidation of LDL could account for the possible anti atherogenic activity of indole-3-carbinol.

A number of mechanisms exist (that are not mutually exclusive) whereby I3C can diminish the effects of estrogen on tumor growth. First, I3C induce enzymes such CYP1A1, which converts estrone to 2-hydroxyestrone and ultimately results in metabolites that are anti-proliferative and proapoptic. Alternative metabolism (16- hydroxylation) of estradiol results in compounds that increase in proliferation and anchorage- independent growth. Second in the case of genes driven by the estrogen receptor (ER), I3C acts as a negative regulator. Estrogens exert their effects by binding to estrogen receptors (ER). Within the nucleus, the estrogen –ER complex can bind to DNA sequences and enhances the transcription of estrogen - responsive genes. Some ER- mediated effects such as, those that promote cellular proliferation in the breast, can increase the risk of developing estrogen-sensitive cancers. The tumor suppressor breast cancer1 (BRCA-1), whose expression is up regulated by I3C, also inhibits the expression of genes driven by ER-Moreover, I3C and BRCA –1 work together to abrogate ER-driven expression.

I3C and estradiol modulate the ER and the aryl hydrocarbon receptor. Thus, estrogen could modulate the activity of I3C as well. Finally, in the absence of estrogen, I3C induce many genes that have the potential to induce growth arrest and apoptosis and therefore might counteract the effects of estradiol.



2-Hydroxyestrone Indolo[3,2b]carbazole3, 3' -Diindolymethane

Studies on cancer prevention of indole-3-carbinol

Epidemiological studies

Like most other vegetables, cruciferous vegetables are good source of a variety of nutrient and phytochemicals that may work synergistically to help prevent cancer. Epidemiological studies provide some support for the hypothesis that higher intakes of cruciferous vegetables are associated with lower risk for some type of cancer. However, cruciferous vegetables are relatively good sources of other phyto-nutrients that may have protective effects against cancer, including vitamin C, folate, selenium, carotenoids and fiber. Moreover, cruciferous vegetables provide a variety of glucosinolates that may be hydrolyzed to a variety of potentially protective of isothiocyanates, in addition to indole-3-carbinol. Consequently, evidence for an inverse association between cruciferous vegetable intake and cancer risk provides relatively little information about the specific effects of indole-3-carbinol on cancer risk.

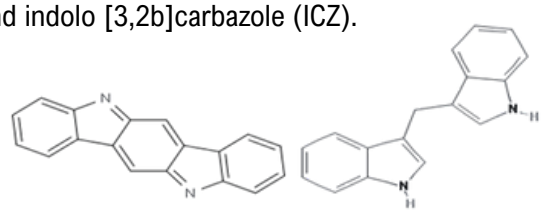
Animal studies

In most animal models, exposure to a chemical carcinogen is required to cause cancer. When administered before or at the same time as the carcinogen, oral I3C has been found to inhibit the

development of cancer in a variety of animal models and tissues, including cancers of themammary gland (breast) , stomach, colon, lung, and liver. However, a number of studies have found that I3C actually promoted or enhanced development of cancer when administered chronically after the carcinogen (post initiation). The cancer promoting effects of I3C were first reported in a throat model of liver cancer. However, I3C has also been found to promote cancer of the liver, thyroid, colon, and uterus in rats. Although the long term effects of I3C supplementation on cancer risk in humans are not known, the contradictory results of animal studies have led several experts to caution against the widespread use of I3C and DIM supplements in humans until their potential risks and benefits are better understood [12].

Derivatives of indole-3-carbinol

Indole-3-carbinol (I3C) and its derivatives are the products of glucosinolate hydrolysis catalyzed by the enzyme myrosinase. Under acidic conditions indole-3-carbinol polymerizes into 3, 3-diindolylmethane (DIM), [2-(Indole-3-ylmethyl) - Indole-3-ylmethane] (LTrl), 1-(3-hydroxymethyl)-indolyl-3-indolylmethane (HI-MI) and indolo [3,2b]carbazole (ICZ).



Indolo[3,2b] carbazole3, 3'-Diinodolylmethane

Discussion

Indole-3-Carbinol and Tamoxifen cooperate to arrest the cell cycle of MCF-7 human breast cancer cells. The current options for treating breast cancer are limited to excision surgery, general chemotherapy, radiation therapy, and, in a minority of breast cancers that rely on estrogen for their growth, anti-estrogen therapy. The naturally occurring chemical indole-3-carbinol (I3C), found in vegetables of the Brassica genus, is a promising anticancer agent that we have shown previously to induce a G1 cell cycle arrest of human breast cancer cell lines, independent of estrogen receptor signaling. Combinations of I3C and the anti-estrogen tamoxifen cooperate to inhibit the growth of the estrogen-dependent human MCF-7 breast cancer cell line more effectively than either agent alone. This more stringent growth arrest was demonstrated by a decrease in adherent and anchorage-independent growth, reduced DNA synthesis, and a shift into the G1 phase of the cell cycle. A combination of I3C and tamoxifen also caused a more pronounced decrease in cyclin-dependent kinase (CDK) 2-specific enzymatic activity than either compound alone but had no effect on CDK2 protein expression. Importantly, treatment with I3C and tamoxifen ablated expression of the phosphorylated retinoblastoma protein (Rb), anendogenous substrate for the G1 CDKs, whereas either agent alone only partially inhibited endogenous Rb phosphorylation. Several lines of evidence suggest that I3C works through a mechanism distinct from tamoxifen. I3C failed to compete with estrogen for estrogen receptor binding, and it specifically down-regulated the expression of CDK6.

These results demonstrate that I3C and tamoxifen work through different signal transduction pathways to suppress the growth of human breast cancer cells and may, therefore, represent a potential combinatorial therapy for estrogen responsive breast cancer.

Akt Inactivation Is a Key Event in Indole-3-carbinol-induced Apoptosis in PC-3 Cells.Indole-3-carbinol (I3C) is a bioactive compound present in Brassica vegetables that shows antitumor activity in experimental animals and inhibits the growth of human cancer cells in vitro. In recent years, studies on prostate cancer (PCa) chemoprevention have been intensified, because there is a long latency for the development of clinical PCa, which makes the PCa a better target for chemoprevention. We have shown previously that I3C induces cell growth inhibition by G1 cell cycle arrest and induces apoptosis in a dose- and time-dependent manner in PC-3 PCa cells; however, the mechanism (s) by which I3C induces apoptosis in PC-3 cells is still not clear. A cell survival pathway involving phosphatidylinositol 3-kinase (PI3K) and Akt is known to play an important role in inhibiting apoptosis in response to growth factor signaling, which prompted us to investigate whether this pathway plays any role in I3C induced apoptosis in PCa cells. Here we report that I3Cinhibits the phosphorylation and subsequent activation of Akt kinase. In addition, I3C abrogated epidermal growth factor (EGF)-induced activation of Akt in PC-3 cells.

Western blot analyses of EGF receptor showed that I3C down regulates the EGF receptor levels and its auto phosphorylation. This was also accompanied by the inhibition of EGF induced phosphorylation of PI3K by I3C treatment. Furthermore, the known downstream modulators of the Akt/PI3K cell survival pathway, Bcl-xL, and BAD proteins showed decreased expression after I3C treatment.

From these results, we conclude that I3C-induced apoptosis is partly mediated by the inhibition of Akt activation, resulting in the alterations in the downstream regulatory molecules of Akt activation in PC-3 cells.

Indole-3-carbinol (I3C) induced cell growth inhibition, G1 cell cycle arrest and apoptosis in prostate cancer cells.

Prostate cancer is one of the most common cancers in men and it is the second leading cause of cancer related death in men in the United States. Recent dietary and epidemiological studies have suggested the benefit of dietary intake of fruits and vegetables in lowering the incidence of prostate cancer. A diet rich in fruits and vegetables provides phytochemicals, particularly indole-3-carbinol (I3C), which may be responsible for the prevention of many types of cancer, including hormone-related cancers such as prostate. Studies to elucidate the role and the molecular mechanism of action of I3C in prostate cancer, however, have not been conducted. In the current study, we investigated whether I3C had any effect against prostate cancer cells and, if so, attempts were made to identify the potential molecular mechanism by which I3C elicits its biological effects on prostate cancer cells. Here we report for the time that I3C inhibits the growth of PC-3 prostate cancer cell.

Induction of G1 cell cycle arrest was also observed in PC-3 cells treated with I3C, which may be due to the observed effects of I3C in the up-regulation of p21WAF1and p27Kip1 CDK inhibitors, followed by their association with cyclin- D1 and E and down-regulation of CDK6 protein kinase levels and activity. The induction of p21WAF1 appears to be transcriptionally up-regulate and independent of the p53 responsive element. In addition, *I3C inhibited the hyper phosphorylation of the Retino-blastoma (Rb) protein in PC-3 cells. Induction of apoptosis was also observed in this cell line when treated with I3C, as measured by DNA laddering and poly (ADP-ribose) polymersae (PARP) cleavage. We also found an up-regulation of Bax, and down-regulation of Bcl-2 in I3C-treated cells. These effects may also be mediated by the down-regulation of NF-kB observed in I3C treated PC-3 cells. From these results, we conclude that I3C inhibits the growth of PC-3 prostate cancer cells by inducing G1 cell cycle arrest leading to apoptosis, and regulates the expression of apoptosis-related genes.

These endings suggest that I3C may be an effective chemopreventive or therapeutic agent against prostate cancer.

Indole-3-carbinol prevents cervical cancer in human papilloma virus type 16 (HPV16) transgenic mice.

Mice that expresses transgenes for human papilloma virus type16 under keratin 14 promoter develop cervical cancer when they are given 17-β estradiol chronically and they studied to determine whether the phytochemical indole-3-carbinol, found in cruciferous vegetables, administered at high doses, would prevent the cervical vaginal cancer that promoted in this mice by high doses of estrogen. They compared mice that were fed a control diet with those that were fed a diet supplemented with 2000ppm I3C. In the group fed the control diet at a dose of estradiol of 0.123mg per 60-day, 19 out of 25 transgenic mice developed cervical vaginal cancer with 6 months, and the remainder had dysplasia. Only 2 mice of 24 in the group fed I3C reduced dysplasia in the known transgenic mice. Similar results were obtained at higher doses of estradiol (0.250mg per 60day release), and I3C help to prevent morbidity associated with the estradiol dose. Additionally, I3C appears to reduce skin cancer in transgenic mice. So their study and the resulting data indicate that I3C is a cancer preventive for cervical vaginal cancer and, possibly, other cancers with papilloma virus component.

Indole-3-carbinol is a naturally occurring phytochemical present in cruciferous vegetables such as cabbage, cauliflower, Brussels etc. These are the metabolic products of glucobrassicin (a sulfur containing compound present in those vegetables). Through different studies and research Indole-3-carbinol is found to have anticancer property. They act as cancer chemo-preventive agents by different

mechanisms, one it increases 2-hydroxylation of estrogen through the induction of cytochrome P4501A1 enzymes, which converts estrone to 2-hydoxyestrone results in metabolites that are anti-proliferative and proapoptic. Alternative metabolism results in the formation of 16-hydroxyestrone, this compounds increase the proliferation. In second mechanism, it acts as a negative regulator in the case of genes driven by estrogen receptors.

When 13C comes in contact with stomach, acid it will rapidly convert it into diindolyl methane (DIM) and indolecarbazole (ICZ). Both the compounds have similar activities regarding the cancer prevention. Indole-3-carbinol also found to have indirect anti-oxidant as well as anti-atherogenic property. And overall indole-3-carbinol is likely safe and less side effects in people when used in amounts typically found in diet.

Conclusion

Incidence of different types of cancer is increasing day by day. According to WHO, cancer is a leading cause of death worldwide. It accounted for 8.2 million deaths. Deaths from cancer worldwide are projected to continue rising, with an estimated 13.1 million deaths in 2030 (about a 70% increase). From the results of different studies, it is found that indole-3-carbinol is a naturally occurring phytochemical present in cruciferous vegetables and have very good anti-cancer property. These facts conclude that including proper amount of cruciferous vegetables in our daily diet can reduce the occurrence of cancer.

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References

1.Wang S. O, Cheng L.S,Wang J.Y and Jiang W.(2016). Indole-3-Carbinol and its derivatives: their pharmacokinetics and important roles in hepatic protection.Curr Drug Metab 17(4):406-409

2.GDB 2015, Disease and injury incidence and prevalence, collaborators. (2016). Global, regional andnational incidence, prevalence and years lived with disability from 310 diseases and injuries, 1990-2015:

3.Jayasekara H, Macinnis R.J, Room R, English I D.R (2016). Long term alcohol consumption and breast, upper aero-digestive tract and colorectacancer risk: A systematic Review and Meta-Analysis. Alcohol. 5l:315-330

4. Lavalee T.M Zhan X.H Herbstritt C.J kough, E.C Green S.J and Pribhula V. S (2002). 2-Methoxyestradiol inhibits proliferation and inducesapoptosis indipendantly of estrogen receptor, Alpha and beta Cancer research.62:3691-3697

5. Jordan V.C, Schafer J.M, Levenson A. S Liu H Pease K.M and Simons,et al.., (2001).Molecular classification of eastrogen .Cancer research,61:6619-6623

6. Liehr J.G (2000). Is estradiol a genotoxic mutagenic carcionogenEndocr REV. 21, 40-54.

7. Hong C, Frirestone G.L, and Bjelandanes L.F (2002). Bcl-2 family medicated apaptotic effects of 3,3'-diindoly lmethane (DIM) in human's breast cancer cells. Biochempharmacol .63:1085-1097.

8. Naughton S.A and Marks G.C (2003). Development of a food composition database for the estimation of dietary intakes of glucosionolates. The biologically active constituents of cruciferous vegetables. Br J. Nutr. 90:687-697. [pubmed].

9. Hecht S.S, Carmella S.G, Kenny P.M, Low S.H, Arakawa K and Yu M C (2004). Effects of cruciferous vegetables consumption on urinary metabolics of the tobacco-specific lung carcinogen 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone in Singapore and Chinese. Cancer Epidemiol Biomarkers Prev. 13:997-1004.

10. Conaway S.S, Yang Y.M, and Chung F.L (2002). Isothioicyanates as cancer chemoprevetive agents: their biological activities and metabolism in rodents and humans. Curr Drug Metab. 3:233-255.

11. Traka M. Chapter Nine – Health benefits of glucosionolates. Advances inBotanical research (2016). 80:247-279.

12. Stoner G, Casto B, Ralston S, Roebuck B, Pereira c and Bailey G (2002) Development of a multi- organ rat model for evaluating chemopreventive agents: efficacy of indole-3-carbinol. Carcinogenesis. 23:265-272.

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Review Article

Journal of Applied and Translational Research in Pharmaceutical Sciences

OCEANS OF INNOVATION: A REVIEW OF MODERN MARINE DERIVED PHARMACEUTICALS

Vinod B.
Professor & Head, Dept. of Pharmaceutical Chemistry, St. Joseph's College of Pharmacy, Cherthala, Kerala, India
*Corresponding Author Email : *vinodbalan76@gmail.com*

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ABSTRACT

Marine organisms represent one of the richest sources of novel bioactive compounds with significant pharmaceutical potential. This review highlights key classes of marine-derived molecules, their therapeutic applications, and recent advancements in drug development. Emphasis is placed on anticancer, antimicrobial, antiviral, analgesic, and anti-inflammatory agents, along with challenges and future prospects in marine bioprospecting.

Key Words: Marine derived pharmaceuticals, anti cancer agents,cyanobacteria, cyto toxic

1. Introduction

The marine environment hosts an extraordinary biodiversity, producing structurally unique secondary metabolites. These metabolites, shaped by extreme ecological conditions, offer promising leads for drug discovery. Since the approval of the first marine-derived drug in the early 2000s, interest in ocean-based pharmaceuticals has increased substantially[1].

2. Major Classes of Marine-Derived Bioactive Compounds

2.1 Peptides and Proteins

Marine sponges, tunicates, and molluscs are recognized sources of bioactive peptides with anticancer and antimicrobial properties. These compounds often act by inhibiting protein synthesis or inducing apoptosis in tumor cells [2].

2.2 Polyketides

Many marine bacteria and dinoflagellates produce polyketides with potent cytotoxic and anti-inflammatory activities. Their complex structures frequently lead to unique mechanisms of action[3,4,5]

2.3 Alkaloids

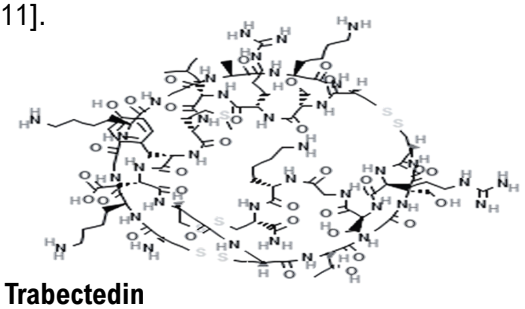
Marine-derived alkaloids show antiviral, analgesic, and neuroprotective potential. Sponges and cyanobacteria are particularly rich in this group [6,7].

2.4 Terpenoids

Commonly isolated from soft corals and algae, marine terpenoids demonstrate antioxidant, anticancer, and antimicrobial effects [8,9].

3. FDA-Approved Marine-Derived Drugs

3.1 Ziconotide derived from cone snail venom, this peptide-based drug is used for severe chronic pain by inhibiting calcium channels in the spinal cord [10,11].

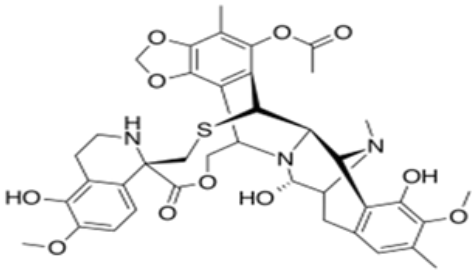


3.2 Trabectedin

Originally isolated from the tunicate Ecteinascidia turbinata, trabectedin is used for soft tissue sarcomas and ovarian cancer. It binds to the DNA minor groove, causing tumor cell apoptosis [12,13,14,15].

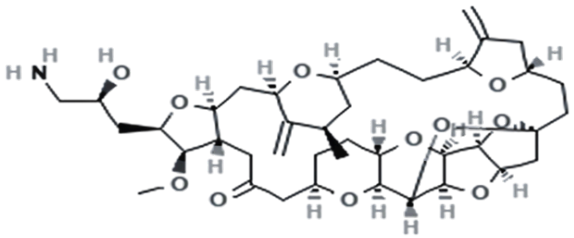
Trabectedin's is a complex marine alkaloid composed of three fused tetrahydroisoquinoline rings. It also

features an eight-ring system with a central carbinolamine moiety, a 10-membered heterocyclic ring containing a cysteine residue, and seven chiral centers. This intricate structure enables it to bind toDNA and interfere with processes like replication and transcription, leading to cancer cell death [16,17,18,19,20].



3.3 Eribulin

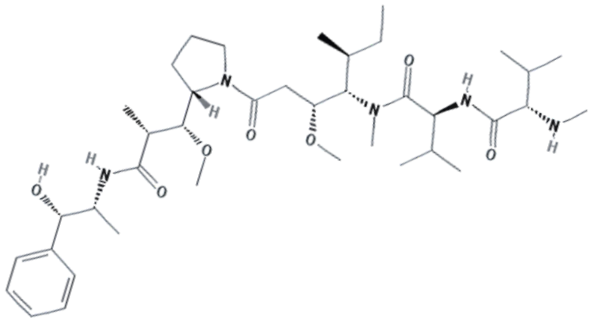
A synthetic analog of a sponge-derived compound, eribulin is employed in metastatic breast cancer therapy by inhibiting



microtubule dynamics [21,22,23]. Eribulin has a complex macrocyclic ketone structure, which is a simplified synthetic analogue of the natural product halichondrin B. It features a macrocyclic ring, polyether structure, and is a cyclic ketone with a primary amino group [24,25].

3.4 Brentuximab Vedotin

A conjugate based on a marine peptide toxin, used for Hodgkin lymphoma and systemic anaplastic large-cell lymphoma [26,27].



Brentuximab vedotin has a three-part structure: a chimeric anti-CD30 antibody, a protease-cleavable linker (valine-citrulline), and the cytotoxic payload monomethyl auristatin E (MMAE) [28].

4. Therapeutic Applications

4.1 Anticancer Activity

Marine organisms produce some of the most promising anticancer agents. Sponges, tunicates, and algae are frequently studied due to their cytotoxic metabolites. Many act on novel drug targets, making them valuable in resistant cancers [29].

4.2 Antimicrobial and Antiviral Agents

Marine bacteria and fungi provide new leads against antibiotic-resistant pathogens.
Compounds with activity against HIV, HSV, and influenza have been identified from algae and cyanobacteria [30].

4.3 Analgesic and Anti-inflammatory Compounds

Venom-derived compounds, algal metabolites, and coral extracts exhibit strong analgesic and anti-inflammatory properties, forming promising alternatives to conventional NSAIDs [31].

4.4 Neurological Applications

Neuroactive toxins from cone snails and jellyfish inspire new treatments for neuropathic pain and neurodegenerative disorders [32].

5. Challenges in Marine Drug Development

·Sourcing difficulty: Many organisms are hard to collect sustainably.
·Low natural yield: Bioactive compounds often occur in minute quantities.
·Complex structures: Structural complexity complicates synthesis and large-scale production.
·Environmental concerns: Overharvesting threatens fragile ecosystems.
·Regulatory and ethical issues: Navigating marine genetic resource rights can delay development.

6. Future Prospects

Advances in aquaculture, microbial fermentation, metabolic engineering, and genomic mining are accelerating the discovery of new marine pharmaceuticals. High-throughput screening and artificial intelligence-based drug design further

enhance the potential for novel therapeutics. Marine biotechnology is expected to play a major role inaddressing global challenges such as antimicrobial resistance and cancer treatment.

7. Conclusion

Marine organisms provide a vast and largely untapped reservoir of pharmacologically valuable molecules. While challenges persist, technological progress continues to improve the feasibility of discovering, isolating, and developing marine-derived drugs. With growing interest and improved sustainable practices, marine pharmacology is poised for significant contributions to modern medicine.

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References

1. Blunt JW, et al. Marine natural products. Nat Prod Rep. 2023;40(1):1-59.
2. Carroll AR, Copp BR, Davis RA, et al. Marine natural products. Nat Prod Rep. 2022;39(2):12-69.
3. Mayer AMS, et al. Marine pharmaceuticals: status and prospects. Pharmacol Rev. 2021;73(3):292-344.
4. Molinski TF, et al. Drug development from marine natural products. Nat Rev Drug Discov. 2009;8(1):69-85.
5. Martins A, et al. Marine-derived anticancer agents. Cancer Treat Rev. 2014;40(6):760-776.
6. Leal MC, et al. Marine bioprospecting. Biotechnol Adv. 2012;30(6):1284-1300.
7. Newman DJ, Cragg GM. Natural products as sources of new drugs. J Nat Prod. 2020;83(3):770-803.
8. Rocha J, et al. Marine sponges as a source of bioactive compounds. Biotechnol Adv. 2011;29(5):462-478.
9. Laport MS, et al. Marine bacteria in drug discovery. Curr Opin Biotechnol. 2020;67:107-115.
10. Hu G, et al. Marine fungi and pharmaceutical potential. J Fungi. 2021;7(3):1-22.
11. Puglisi MP, et al. Secondary metabolites from tunicates. Chem Rev. 2014;114(1):181-226.
12. Hallegraeff G. Marine microalgae as bioactive sources. J Appl Phycol. 2010;22:559-567.
13. Kijjoa A, Sawangwong P. Marine-derived fungi and bioactive metabolites. Mar Drugs. 2004;2(2):73-96.
14. Bhatnagar I, Kim SK. Immense fungal resources from the oceans. Mar Drugs. 2010;8(3):513-529.
15. Vignesh S, et al. Marine peptides: therapeutic potential. Peptides. 2022;150:170741.
16. Trimurtulu G, et al. Ecteinascidin-743 discovery. J Am Chem Soc. 1994;116:10837-10838.
17. Safavi-Hemami H, et al. Cone snail toxins.
Annu Rev Biochem. 2019;88:353-380.18. Bai R, et al. Halichondrin B mechanism. Proc Natl Acad Sci USA. 1991;88:1182-1186.
19. DeVita VT, et al. Cancer drug development. CA Cancer J Clin. 2011;61:364-377.
20. Tedesco SA, et al. Marine alkaloids in drug discovery. Mar Drugs. 2020;18(3):123.
21. Mehbub MF, et al. Marine terpenoids. Mar Drugs. 2014;12:255-273.
22. Sagar S, et al. Anticancer compounds from marine organisms. Cancer Lett. 2010;288:7-17.
23. Malve H. Marine antimicrobial compounds. Front Microbiol. 2016;7:1-16.
24. Mayer AMS, et al. Marine toxins as analgesics. Toxins. 2011;3(9):1429-1451.
25. Clark RF. Jellyfish toxins. Ann Emerg Med. 2005;45:168-174.
26. Jiménez C. Marine polyketides. Nat Prod Rep. 2018;35:386-412.
27. Salvador-Reyes LA, Luesch H. Marine cyanobacteria and drug potential. Nat Prod Rep. 2015;32:478-503.
28. Carroll AR, et al. Marine natural product pipelines. Bioorg Med Chem. 2019;27:115–121.
29. Rateb ME, Ebel R. Marine actinomycetes. Nat Prod Rep. 2011;28:290-344.
30. Hu G, et al. Aquaculture for marine drug production. Biotechnol Adv. 2020;41:1-18.
31. Skropeta D. Deep-sea natural products. Mar Drugs. 2008;6:463-479.
32. Zhang H, et al. Genomic mining of marine microbes. Trends Biotechnol. 2021;39(7):737-749.

Review Article

Journal of Applied and Translational Research in Pharmaceutical Sciences

BRAIN- EATING AMOEBA AND PRIMARY AMOEBIC MENINGOENCEPHALITIS: A REVIEW

Noby Thomas
Associate Professor, Dept. of Pharmaceutics, St. Joseph's College of Pharmacy, Cherthala, Kerala, India
*Corresponding Author Email : *nobysjcp@gmail.com*

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ABSTRACT

Primary Amoebic Meningoencephalitis (PAM) is a rapidly progressive and almost universally fatal infection of the central nervous system caused by *Naegleria fowleri*, popularly referred to as the "brain-eating amoeba." Although considered uncommon, the rising number of cases reported in India—especially in Kerala—indicates the growing significance of this pathogen from a public health perspective. Infection occurs when contaminated warm freshwater enters the nasal passages, allowing the amoeba to ascend through the olfactory nerves and invade the brain. Because the clinical picture closely resembles acute bacterial meningitis, diagnosis is often delayed, contributing to poor survival rates. This review provides an updated overview of epidemiology, risk determinants, mechanisms of pathogenesis, clinical profile, diagnostic considerations, therapeutic challenges, and preventive measures, with emphasis on implications for healthcare workers. Early suspicion coupled with aggressive combination therapy remains the only chance for survival. Reinforcing water safety practices, improving clinician knowledge, and promoting community-level awareness are key preventive strategies.

Key Words: Primary Amoebic Meningoencephalitis, brain-eating amoeba, combination therapy, *Naegleria fowleri*

Introduction

Primary Amoebic Meningoencephalitis (PAM) is an acute, destructive infection of the CNS caused by the thermophilic, free-living amoeba *Naegleria fowleri*. Though rare, it is associated with a case-fatality rate exceeding 97%, making it one of the deadliest infectious diseases known. Since its recognition in 1962, only around 500 cases have been documented worldwide, although the actual number is likely higher due to diagnostic challenges and underreporting. A noticeable rise in cases from India —particularly Kerala in 2025—suggests a possible link to climatic shifts, increasing freshwater temperatures, and water quality issues [1,2].

This review compiles current evidence for clinicians, microbiologists, and public health teams, highlighting the importance of early recognition and preventive interventions.

Etiology and Biology of *Naegleria fowleri*

Naegleria fowleri is naturally found in warm freshwater environments. It exists in three developmental stages, each essential for its survival and infectivity:

- Cyst: Dormant, protective form enabling
- persistence in harsh conditions.
- Trophozoite: Active, feeding, and pathogenic stage responsible for invading human tissue.
- Flagellate: Temporary motile form triggered by environmental changes.

The amoeba thrives at temperatures between 35–46°C, explaining its prevalence in tropical and subtropical regions [2,3].

Epidemiology

PAM has been reported across multiple continents, with

higher occurrence in warm-climate regions including the United States, Australia, Pakistan, and India. Although only a few hundred cases have been confirmed globally, seasonal peaks and sporadic outbreaks are common.

In India, cases have emerged from Kerala, Gujarat, and Tamil Nadu, with Kerala witnessing an unusual rise in 2025. Increased water temperatures, changing rainfall patterns, and improved diagnostic capacity may have contributed to this trend.

Risk Factors

Major exposure sources include:

- Swimming, diving, or submersion in warm, stagnant lakes or ponds.
- Use of poorly chlorinated or untreated swimming pools.
- Nasal exposure to unsafe water during ritual cleansing or nasal irrigation.
- Engagement in freshwater activities during hot seasons.

Climate change and improved testing practices have also played a role in the increasing number of reported infections.

Pathogenesis

Infection begins when contaminated water enters the nasal cavity. The trophozoites attach to the olfactory mucosa, migrate through the cribriform plate, and travel along the olfactory nerves into the brain. Once in the CNS, they replicate rapidly and trigger extensive inflammation and tissue necrosis.

Route of CNS invasion

- Passage through the cribriform plate
- Direct invasion of neural tissue
- Induction of hemorrhagic necrosis and severe neutrophilic inflammation

Extensive cortical destruction typically occurs within days, leading to rapid deterioration and death[3].

Clinical Features

Symptoms generally develop 1–9 days after exposure and advance swiftly over 5–7 days.

Early Symptoms (Days 1–3)

- Severe frontal headache
- High-grade fever
- Nausea and vomiting

Progressive Stage (Days 3–5)

- Neck rigidity
- Photophobia
- Confusion, irritability, or behavioral changes

Late/Critical Stage (Days 5–7)

- Seizures
- Coma
- Respiratory compromise
- Death

Because the presentation resembles acute bacterial meningitis, diagnosis requires careful assessment of exposure history.

Diagnostic Evaluation

Cerebrospinal Fluid (CSF) Findings

Typical features include:

- Elevated protein
- Low glucose
- Neutrophilic pleocytosis
- Motile trophozoites on fresh CSF wet mount—a critical bedside clue

Confirmatory Tests

- PCR for *N. fowleri* DNA
- Immunofluorescence assays
- Neuroimaging: diffuse cerebral edema, hemorrhagic lesions

Early diagnosis (within 24–48 hours) is critical for any chance of survival[3].

Treatment

Survival outcomes remain extremely poor, with fewer than ten well-documented survivors worldwide. All survivors were diagnosed early and received intensive, combined therapy.

Primary Treatment Components

- Amphotericin B (intravenous ± intrathecal)
- Miltefosine (key modern therapeutic option)
- Azoles such as fluconazole or voriconazole
- Azithromycin
- Rifampicin (used as adjunctive therapy)

Supportive Critical Care

- Monitoring and management of intracranial pressure
- Seizure control
- Mechanical ventilation when necessary

- Stabilization of cardiovascular and metabolic parameters

Despite aggressive multimodal therapy, the prognosis remains extremely poor.

Prevention and Public Health Strategies

Recreational Water Safety

- Avoiding warm, stagnant freshwater sources
- Using nose clips during water-based activities

Water Quality Management

- Maintaining adequate chlorine levels in pools
- Regular inspection and sanitation of community water systems.

Safe Nasal Practices

- Using sterile, boiled-and-cooled, or distilled water for nasal cleansing and ritual practices.

Healthcare and Community Awareness

- Training healthcare workers to recognize early symptoms
- Encouraging prompt reporting and investigation of suspected cases
- Public education campaigns, including nurse-driven community based health promotion programs
- Strong surveillance and timely public health interventions are essential to reduce disease incidence [3,4].

Discussion

Although uncommon, PAM's extremely high fatality rate and rising reported cases in regions such as Kerala highlight the urgent need for enhanced surveillance and clinician awareness. Climate-driven changes in water temperature and environmental conditions may be expanding the habitat of *N. fowleri*. Since early symptoms resemble common meningitis, diagnostic delays remain the main barrier to survival. Strengthening laboratory capabilities for rapid wet-mount examination and PCR testing is crucial. Public health messaging on safe water practices, especially during hotter months, can significantly mitigate risk.

Conclusion

Primary Amoebic Meningoencephalitis remains a devastating but underrecognized infection. The combination of rapid disease progression, limited diagnostic capacity, and widespread freshwater exposure underscores the importance of early suspicion, prompt treatment, and robust preventive strategies. Enhancing community awareness, maintaining water safety standards, and training healthcare providers are essential steps toward reducing the burden of this almost invariably fatal disease. As environmental temperatures continue to rise, PAM may increasingly emerge as a significant infectious disease threat.

References

1. Visvesvara GS, Moura H, Schuster FL. Pathogenic and opportunistic free-living amoebae: *Naegleria*, *Acanthamoeba, Balamuthia*, and *Sappinia* species. FEMS Immunol Med Microbiol. 2007;50(1):1–26.
2.Capewell LG, Harris AM, Yoder JS, et al. Diagnosis, clinical course, and treatment of primary amoebic meningoencephalitis in the United States, 1937–2013. J Pediatric Infect Dis Soc. 2015;4(4):e68-75.
3.World Health Organization. Free-living amoebic infections [Internet]. WHO; 2024 [cited 2025 Nov]. Available from: https://www.who.int/
4.Cope JR, Ali IK. Primary Amebic Meningoencephalitis: What Have We Learned in the Last Five Years? Curr Infect Dis Rep. 2016;18(10):31.

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