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The therapeutic potential of skin mucus from Asian swamp eel (Monopterus albus): In vivo evaluation and histological evidence

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Abstract

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Abstract

Objectives: The Asian swamp eel (Monopterus albus), is commonly distributed in Asian countries. However, its therapeutic potential has not been thoroughly investigated yet. The current study aimed to evaluate the in-vivo therapeutic properties of the skin mucus of this fish. Methods: The eel mucus was collected fleshly and topical gel with carbopol 934 was formulated to study the antibacterial activity on the infected skin of the rats. Sprague Dawley rats were used in the study and divided into 4 groups negative, positive, normal control, and treated groups. Results: Intracutaneous injections of pathogenic bacteria (Streptococcus pyogenes, Staphylococcus aureus) and fungi (Microsporum gypseum, Candida albicans) were injected into the rats. The development of tinea capitis, impetigo, and cutaneous candidiasis in the animal model was confirmed based on clinical and histopathological observations. To treat the infected rats, a formulated gel of eel skin mucus was applied on the infected rat's skins topically. The histological analysis confirms a complete recovery in the skin tissues similar to commercial antifungal and antibacterial agents used in the positive control groups. Conclusion: The present novel eel skin mucus is an efficient therapeutic candidate in treating skin infections associated with pathogenic microbes. © 2022 The Author(s)

Author keywords

Eel skin mucus ; Intracutaneous injections; Monopterus albus; Skin infections

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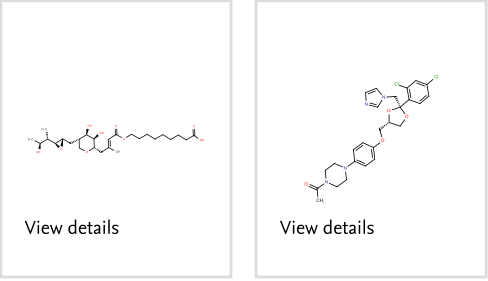

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References (46)

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1 Hay, R.J., Johns, N.E., Williams, H.C., Bolliger, I.W., Dellavalle, R.P., Margolis, D.J., Marks, R., (...), Naghavi, M.

The global burden of skin disease in 2010: An analysis of the prevalence and impact of skin conditions (Open Access)

(2014) *Journal of Investigative Dermatology*, 134 (6), pp. 1527-1534. Cited 674 times.
http://www.nature.com/jid/index.html
doi: 10.1038/jid.2013.446

View at Publisher

2 Gonzalez, A., Bischoff, T., Tallent, S., Sheke, G., Ostrowsky, B., Edmond, M.B., Wenzel, R.P.
Antibiotic resistance in the community [4]
(2003) *Journal of Hospital Infection*, 55 (2), pp. 156-157. Cited 10 times.
doi: 10.1016/S0195-6701(03)00196-8
View at Publisher

3 Veien, N.K.
The clinician's choice of antibiotics in the treatment of bacterial skin infection
(1998) *British Journal of Dermatology, Supplement*, 139 (53), pp. 30-36. Cited 35 times.
www.blacksci.co.uk/~cgilib/jnlpage.bin?Journal=bjd&File=bjd&Page=aims
doi: 10.1046/j.1365-2133.1998.1390s3030.x
View at Publisher

4 Peleg, A.Y., Hogan, D.A., Mylonakis, E.
Medically important bacterialg-fungal interactions
(2010) *Nature Reviews Microbiology*, 8 (5), pp. 340-349. Cited 336 times.
doi: 10.1038/nrmicro2313
View at Publisher

5 Dollive, S., Peterfreund, G.L., Sherrill-Mix, S., Bittinger, K., Sinha, R., Hoffmann, C., Nabel, C.S., (...), Bushman, F.D.
A tool kit for quantifying eukaryotic rRNA gene sequences from human microbiome samples (Open Access)
(2012) *Genome biology*, 13 (7), p. R60. Cited 85 times.
doi: 10.1186/gb-2012-13-7-r60
View at Publisher

6 James, T.Y., Kauff, F., Schoch, C.L., Matheny, P.B., Hofstetter, V., Cox, C.J., Celio, G., (...), Vilgalys, R.
Reconstructing the early evolution of Fungi using a six-gene phylogeny
(2006) *Nature*, 443 (7113), pp. 818-822. Cited 1285 times.
http://www.nature.com/nature/index.html
doi: 10.1038/nature05110
View at Publisher

7 Rossen, D.E., Greenwood, P.H.
A fourth neotropical species of Synbranchid eel and the phylogeny and systematics of Synbranchiform fishes
(1976) *Bull. Am. Museum Natural History*, 157, pp. 1-69. Cited 89 times.
URI
http://hdl.handle.net/2246/620

8 Collins, T.M., Trexler, J.C., Nico, L.G., Rawlings, T.A.
Genetic diversity in a morphologically conservative invasive taxon: Multiple introductions of swamp eels to the southeastern United States

(2002) *Conservation Biology*, 16 (4), pp. 1024-1035. Cited 66 times.
doi: 10.1046/j.1523-1739.2002.01182.x

View at Publisher

9 Schofield, P.J., Nico, L.G.
Salinity tolerance of non-native Asian swamp eels (Teleostei: Synbranchidae) in Florida, USA: Comparison of three populations and implications for dispersal

(2009) *Environmental Biology of Fishes*, 85 (1), pp. 51-59. Cited 23 times.
doi: 10.1007/s10641-009-9456-9

View at Publisher

10 Pedersen, P.B.M., Hansen, K., Houng, D.T.T., Bayley, M., Wang, T.
Effects of salinity on osmoregulation, growth and survival in Asian swamp eel (Monopterus albus) (Zuiew 1793)

(2014) *Aquaculture Research*, 45 (3), pp. 427-438. Cited 17 times.
doi: 10.1111/j.1365-2109.2012.03244.x

View at Publisher

11 Tok, C.Y., Chew, S.F., Peh, W.Y.X., Loong, A.M., Wong, W.P., Ip, Y.K.
Glutamine accumulation and up-regulation of glutamine synthetase activity in the swamp eel, Monopterus albus (Zuiew), exposed to brackish water (Open Access)

(2009) *Journal of Experimental Biology*, 212 (9), pp. 1248-1258. Cited 23 times.
http://jeb.biologists.org/cgi/reprint/212/9/1248
doi: 10.1242/jeb.025395

View at Publisher

12 Tok, C.Y., Chew, S.F., Ip, Y.K.
Gene cloning and mRNA expression of glutamate dehydrogenase in the liver, brain, and intestine of the swamp eel, Monopterus albus (Zuiew), exposed to freshwater, terrestrial conditions, environmental ammonia, or salinity stress (Open Access)

(2011) *Frontiers in Physiology*, 2 DEC, art. no. Article 100. Cited 12 times.
http://www.frontiersin.org/Journal/DownloadFile.ashx?pdf=1&FileId=2709&articleId=15777&Version=1&ContentTypeId=21&FileName=fphys-02-00100.pdf
doi: 10.3389/fphys.2011.00100

View at Publisher

13 Saylor, R.K., Schofield, P.J., Bennett, W.A.
Non-native Asian swamp eel, Monopterus albus/javanensis (Zuiew, 1973/Lacepede, 1800), responses to low temperatures

(2021) *Fish Physiology and Biochemistry*, 47 (2), pp. 465-476.
http://www.kluweronline.com/issn/0920-1742/
doi: 10.1007/s10695-021-00925-w

View at Publisher

14 Nor, M., Ikram, N.M., Hashim, R.
A preliminary screening of antifungal activity from skin mucus extract of Malaysian local swamp eel (Monopterus albus)
(2013) *Int. Res. J. Pharmacy Pharmacol.gy*, 3 (1), pp. 1-8. Cited 3 times.

15 Atif, A.B., Zahri, M.K., Nordin, S., Esa, A.R., Zilfalil, B.A., Mahadeva Rao, U.S.
Comparative analysis of the antibacterial, antifungal, antiproliferative and cyclic response element (CRE) induced expression of downstream luc gene activities of Monopterus albus and Channa straitus extracts

(2015) *Journal of Applied Pharmaceutical Science*, 5 (1), pp. 042-047. Cited 2 times.
http://www.japsonline.com/admin/php/uploads/1411_pdf.pdf
doi: 10.7324/JAPS.2015.50108

View at Publisher

16 Kwak, C.-H., Lee, S.-H., Lee, S.-K., Ha, S.-H., Suh, S.-J., Kwon, K.-M., Chung, T.-W., (...), Kim, C.-H.
Induction of apoptosis and antitumor activity of eel skin mucus, containing lactose-binding molecules, on human leukemic K562 cells (Open Access)

(2015) *Marine Drugs*, 13 (6), pp. 3936-3949. Cited 15 times.
http://www.mdpi.com/1660-3397/13/6/3936/pdf
doi: 10.3390/md13063936

View at Publisher

17 Hilles, A.R., Mahmood, S., Hashim, R.
Evaluation of the antibacterial activities of skin mucus from Asian swamp eel (Monopterusalbus)

(2019) *Indian Journal of Geo-Marine Sciences*, 48 (12), pp. 1855-1859.
http://nopr.niscair.res.in/bitstream/123456789/52808/1/IJMS%2048%2812%29%201855-1859.pdf

18 Hilles, A.R., Mahmood, S., Kaderi, M.A., Hashim, R.
Evaluation Of The Antimicrobial Properties Of Eel Skin Mucus From Monopterus Albus Against Selected Oral Pathogens And Identification Of The Anti-Oral Bioactive Compounds Using Lc-Qtof-Ms (Open Access)

(2019) *Journal of Microbiology, Biotechnology and Food Sciences*, 9 (1), pp. 140-143. Cited 2 times.
https://office2.jmbfs.org/index.php/JMBFS/index
doi: 10.15414/JMBFS.2019.9.1.140-143

View at Publisher

19 Ikram, N.M.M.N., Ridzwan, B.H.
A preliminary screening of antifungal activities from skin mucus extract of Malaysian local swamp eel (Monopterus albus)
(2013) *Int. Res. J. Pharmacy Pharmacol.*, 3 (1), pp. 1-8. Cited 3 times.

20 Hilles, A.R., Mahmood, S., Kaderi, M.A., Hashim, R., Jalal, T., Salleh, M.A.
In-vitro evaluation of the antifungal activities of eel skin mucus from Asian swamp eel (Monopterus albus)
(2019) *Fungal Territory*, 2 (1), pp. 1-2.

21 Hilles, A.R., Mahmood, S., Kaderi, M.A., Hashim, R.
Activation of apoptotic cell death by skin mucus from Asian swamp eel (Monopterus albus) against human lung cancer cell line
(2020) *J. Agric. Mar. Sci. [JAMS]*, 24, pp. 39-43.

22 Sadakane, Y., Konoha, K., Nagata, T., Kawahara, M.
Protective activity of the extracts from Japanese eel (Anguilla japonica) against zinc-induced neuronal cell death: Carnosine and an unknown substance
(2007) *Trace Nutr. Res.*, 24, pp. 98-105. Cited 11 times.
URL
http://jtnrs.com/sym24/24_098.pdf

23 Vanessa Maria Fagundes, L., Pinheiro, J.B., Pisani, M.X., Watanabe, E., Freitas de Souza, R., de Freitas Oliveira Paranhos, H., Lovato-Silva, C.H.
In vitro antimicrobial activity of an experimental dentifrice based on Ricinus Communis (Open Access)

(2014) *Brazilian Dental Journal*, 25 (3), pp. 191-196. Cited 18 times.
http://www.scielo.br/pdf/bdj/v25n3/0103-6440-bdj-25-03-00191.pdf
doi: 10.1590/0103-6440201302382

View at Publisher

24 Petrikkou, E., Rodríguez-Tudela, J.L., Cuenca-Estrella, M., Gómez, A., Molleja, A., Mellado, E.
Inoculum standardization for antifungal susceptibility testing of filamentous fungi pathogenic for humans (Open Access)

(2001) *Journal of Clinical Microbiology*, 39 (4), pp. 1345-1347. Cited 86 times.
doi: 10.1128/JCM.39.4.1345-1347.2001

View at Publisher

25 Mölne, L., Tarkowski, A.
An experimental model of cutaneous infection induced by superantigen- producing Staphylococcus aureus (Open Access)

(2000) *Journal of Investigative Dermatology*, 114 (6), pp. 1120-1125. Cited 24 times.
http://www.nature.com/jid/index.html
doi: 10.1046/j.1523-1747.2000.00973.x

View at Publisher

26 Stevens, D.L., Bryant, A.E. (2016)
Impetigo, erysipelas and cellulitis. URL: https://www.ncbi.nlm.nih.gov/books/NBK333408/

27 Ghaisas, M.M., Kshirsagar, S.B., Sahane, R.S.
Evaluation of wound healing activity of ferulic acid in diabetic rats (Open Access)

(2014) *International Wound Journal*, 11 (5), pp. 523-532. Cited 49 times.
http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1742-481X
doi: 10.1111/j.1742-481X.2012.01119.x

View at Publisher

28 (2001)
29. Hardman, J.G. Limbird, LE. Goodman and Gilmans. The pharmacological Basis of therapeutics, 10. DOI:

29 Kumar, J.R., Muralidharan, S., Parasuraman, S.
In vitro and in vivo evaluation of microspheres loaded topical gel delivery system of ketoconazole in male rats against Candida glabrata

(2014) *Journal of Pharmaceutical Sciences and Research*, 6 (11), pp. 376-381. Cited 6 times.
http://www.jpsr.pharmainfo.in/Documents/Volumes/Vol6Issue11/jpsr06111409.pdf

30 Elewski, B.E.
Tinea capitis: A current perspective

(2000) *Journal of the American Academy of Dermatology*, 42 (1 I), pp. 1-20. Cited 297 times.
http://www.elsevier.com/inca/publications/store/6/2/3/3/7/0/index.htt
doi: 10.1016/s0190-9622(00)90001-x

View at Publisher

31 Elewski, B., Ling, M.R., Phillips, T.J.
Efficacy and safety of a new once-daily topical ketoconazole 2% gel in the treatment of seborrheic dermatitis: a phase III trial.

(2006) *Journal of drugs in dermatology : JDD*, 5 (7), pp. 646-650. Cited 29 times.

32 Porumb, V., Trandabst, A.F., Terinte, C., Csruntu, I.D., Porumb-Andrese, E., Dimofte, M.G., Pieptu, D.G.
Design and testing of an experimental steam-induced burn model in rats (Open Access)

(2017) *BioMed Research International*, 2017, art. no. 9878109. Cited 10 times.
http://www.hindawi.com/journals/biomed/
doi: 10.1155/2017/9878109

View at Publisher

El Ghannoum, M.A., Hossain, M.A., Long, L., Mohamed, S., Reyes, G., Mukherjee, P.K.

Evaluation of antifungal efficacy in an optimized animal model of Trichophyton mentagrophytes-dermatophytosis

(2004) *Journal of Chemotherapy*, 16 (2), pp. 139-144. Cited 41 times.
http://www.maneyonline.com/loi/joc
doi: 10.1179/joc.2004.16.2.139

View at Publisher

34 Sternberg, S.S., Mills, S.E., Carter, D.
(2004)
(Eds.) Sternberg's diagnostic surgical pathology (Vol. 1). Lippincott Williams & Wilkins.

35 Sahin, H.Guler, Sahin, H.A., Metin, A., Zeteroglu, S., Ugras, S.

Recurrent impetigo herpetiformis in a pregnant adolescent: Case report

(2002) *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 101 (2), pp. 201-203. Cited 34 times.
www.elsevier.com/locate/ejogrb
doi: 10.1016/S0301-2115(01)00577-2

View at Publisher

36 Kondo, R.N., Lopes, V.C.H., Araújo, F.M., Martins, L.M.M., Pereira, A.M.

Pustular psoriasis of pregnancy (impetigo herpetiformis) - Case report (Open Access)

(2013) *Anais Brasileiros de Dermatologia*, 88 (6 SUPPL.1), pp. 186-189. Cited 18 times.
http://www.scielo.br/pdf/abd/v88n6s1/0365-0596-abd-88-06-s1-0186.pdf
doi: 10.1590/abd1806-4841.20132134

View at Publisher

37 Freedberg, I.M., Fitzpatrick, T.B.
, p. 645.
ISBN 0-07-138076-0. 1., 2003. Fitzpatrick's Dermatology in General Medicine. New York: McGraw-Hill, Medical Pub. Division;

38 Howard, D.H.
(2002)
(Ed.) Pathogenic fungi in humans and animals. CRC Press.

39 Rippon, J.W.
Medical mycology; the pathogenic fungi and the pathogenic actinomycetes
(1982) . Cited 1075 times.
WB Saunders Company Eastbourne, UK

40 Isa Isa, R., Arenas, R., Isa, M.
Inflammatory tinea capitis: Kerion, dermatophytic granuloma, and mycetoma

(2010) *Clinics in Dermatology*, 28 (2), pp. 133-136. Cited 55 times.
doi: 10.1016/j.clindermatol.2009.12.013

View at Publisher

41 Guarner, J., Brandt, M.E.
Histopathologic diagnosis of fungal infections in the 21st century (Open Access)

(2011) *Clinical Microbiology Reviews*, 24 (2), pp. 247-280. Cited 410 times.
http://cmr.asm.org/cgi/reprint/24/2/247
doi: 10.1128/CMR.00053-10

View at Publisher

42 Gisby, J., Bryant, J.
Efficacy of a new cream formulation of mupirocin: Comparison with oral and topical agents in experimental skin infections (Open Access)

(2000) *Antimicrobial Agents and Chemotherapy*, 44 (2), pp. 255-260. Cited 87 times.
doi: 10.1128/AAC.44.2.255-260.2000

View at Publisher

43 Greer, D.L.
Successful treatment of tinea capitis with 2% ketoconazole shampoo

(2000) *International Journal of Dermatology*, 39 (4), pp. 302-304. Cited 48 times.
doi: 10.1046/j.1365-4362.2000.00885.x

View at Publisher

44 Gupta, M., Goyal, A.K., Paliwal, S.R., Paliwal, R., Mishra, N., Vaidya, B., Dube, D., (...), Vyas, S.P.
Development and characterization of effective topical liposomal system for localized treatment of cutaneous candidiasis

(2010) *Journal of Liposome Research*, 20 (4), pp. 341-350. Cited 66 times.
doi: 10.3109/08982101003596125

View at Publisher

45 Chhibber, T., Wadhwa, S., Chadha, P., Sharma, G., Katare, O.P.
Phospholipid structured microemulsion as effective carrier system with potential in methicillin sensitive Staphylococcus aureus (MSSA) involved burn wound infection

(2015) *Journal of Drug Targeting*, 23 (10), pp. 943-952. Cited 33 times.
doi: 10.3109/1061186X.2015.1048518

View at Publisher

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