In-Vitro Anti-Tubercular Effect of Three Different Hypnea SP Algal Extract Against Mycobacterium SP

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**Abstract:** Medicinal plants are the chief components in the different oriental formulations in different traditional medical systems worldwide. As a thriving source of medicine, the medicinal plants with antituberculosis (TB) properties inspire the pharmacists to develop new drugs based on their active components or semi-metabolites. In the present study the anti-TB effect of three different algae*Hypnea valentiae, Hypnea musciformis, Hypnea flagelliformis* extract was screened against *Mycobacterim tuberculosis* (H37Rv strain, SIT777, SIT26, SIT73 strain). Out of the threeextracts *Hypnea flagelliformis* and *Hypnea valentiae* have significant anti-tubercular effect when compared to the standard drug Rifampcin which is validated through preliminary experimental results. Further research on this will lead to anti-tubercular adjuvant therapy molecule isolation from this for anti-TB therapy.

**Keywords:** Hypnea, Anti-tuberculosis, Rifampcin, Extract, Health and wellbeing.

# Introduction

Traditional medicines (TM) play a significant role in the global health care sector. Particularly in the rural sector, TM is sometimes the only or sometimes the primary source of healthcare in various nations [(Agyare et al., 2009; Fokunang et al., 2011)](https://paperpile.com/c/T8ttX5/RdTmX+JM8fv) The effectiveness of these TM was demonstrated by the ethno pharmacological research, which is just one of many factors driving TM's rise in popularity in industrialized nations [(Aparna et al., 2021; Ganapathy, 2021)](https://paperpile.com/c/T8ttX5/Ii3y+oGJd). The Department of Traditional Medicine (DTM) was created by the World Health Organization (WHO) in the beginning of 1972 [(Achoundong et al., 2003)](https://paperpile.com/c/T8ttX5/nfcbn). Later, WHO (2013) urged strengthening its public traditional medicine services. In the most recent version of the International Classification of Diseases-11 (ICD-11), the International Classification of Traditional Medicine (ICTM) was added as a new chapter [(Chang & Zhao, 2021)](https://paperpile.com/c/T8ttX5/48iuG)This accomplishment currently only applies to Traditional Chinese Medicine (TCM), which has opened its doors to many other thriving traditional medical systems that are widely practised today, including Ayurveda and Traditional African medicine (TAM) [(Calapai & Caputi, 2007; Verma & Muthuswamy Pandian, 2021)](https://paperpile.com/c/T8ttX5/UiBi+QJFz).

With the migration of Homo sapiens, particularly along the established trade routes with greater population mingling and crowding, tuberculosis (TB) spread from East Africa to the rest of the world. Currently, there exist more than 10 million new cases of active disease and nearly 1.3 million deaths annually [(Comas et al., 2013; Pezzella, 2019)](https://paperpile.com/c/T8ttX5/iiScJ+EMhdn). Studies on TM formulations reveal that the traditional anti-TB formula's primary ingredient is a plant or herb, from which the active ingredients or semi-metabolites are a thriving source of new medications [(Poornima et al., 2021)](https://paperpile.com/c/T8ttX5/LAhk). Nearly 50% of pharmaceuticals that the FDA has approved in the previous 20 years in the United States of America are natural product derivatives, including natural plant products [(Uc-Cachón et al., 2014)](https://paperpile.com/c/T8ttX5/Cl2Q). Around 70,000 plant species are thought to be used as medicines out of the 435,000 plant species known worldwide [(Mann et al., 2008)](https://paperpile.com/c/T8ttX5/RQF1). Choosing plants accordingly can increase the likelihood of discovering novel chemicals with anti-TB action [(Ganapathy, 2021; Merchant et al., 2022; Pandiyan et al., 2022)](https://paperpile.com/c/T8ttX5/ejaa+15Qr+tOEJ).

The genus Hypnea belongs to the family Cystocloniaceae, order Gigartinales, and class Florideophyceae of red seaweeds [(Chokkattu et al., 2022; Marya et al., 2022; Ramamurthy et al., 2022)](https://paperpile.com/c/T8ttX5/110F+WAHw+4Nmi). Algae Base lists 99 species, 78 of which are taxonomically recognised. The family Hypneaceae, which was distinguished from Cystoclonoiaceae by differences in their carposporophyte structures and the shapes of their thalli and cortical cells, previously contained the genus. The extracts of various Hypnea species have been investigated for their antiviral, antibacterial, antioxidant, and antifungal properties [(Jain & Verma, 2022; Sreevarun et al., 2023; Wadhwani et al., 2022)](https://paperpile.com/c/T8ttX5/JnGg+OBcl+4TZL). The present study aims to focus on the antitubercular effect of the three different seaweeds *Hypnea oagelliformis*, *H. musciformis*, and *Hypnea valentiae*.

# Materials and methods

## Sample collection and extraction

Seaweed samples of *Hypnea flagelliformis*, *H. musciformis,* and *Hypnea valentiae* were collected from the Rameshwaram gulf biosphere reserve coastal areas (Lat’ 9.2876° N, Long’ N: 79.3129° E). Collected seaweed samples were washed extensively with fresh water and then extracted with methanol (Weight/volume). The methanol extract was dried and powdered. The dried extract was then used for biological screening [(Rakhmawatie et al., 2019; Wassie et al., 2021)](https://paperpile.com/c/T8ttX5/K9J0+7LD4)

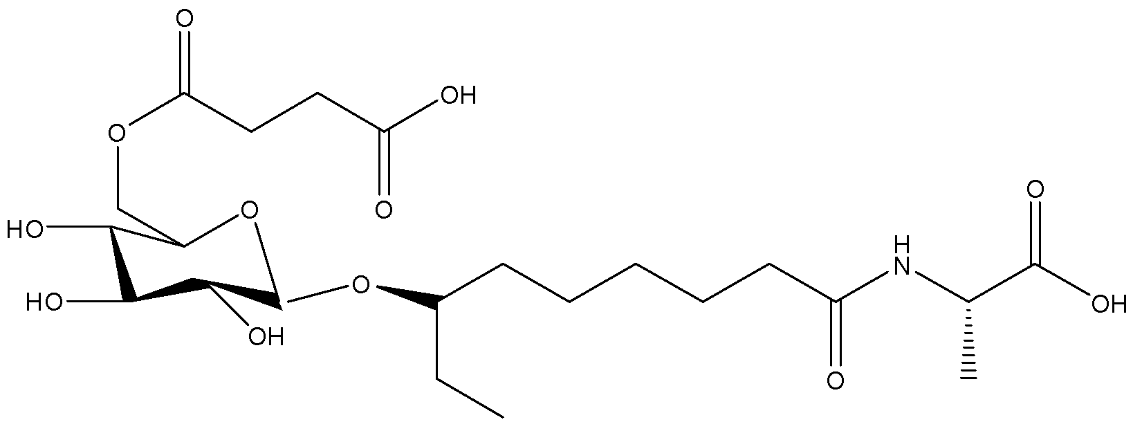


Figure 1: sample

## Anti-tuberculosis assay

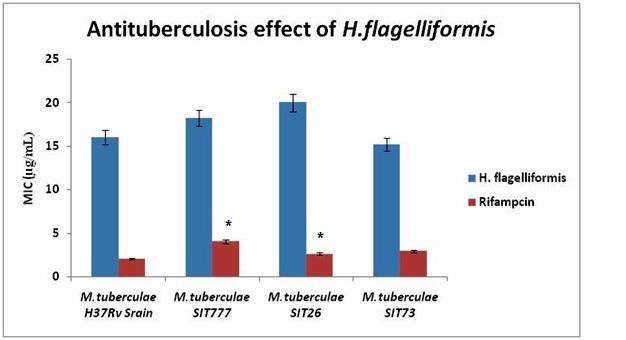
The antimycobacterial activity of 80% methanolic crude extracts of Three different sea weed extracts of *Hypnea flagelliformis*, *H. musciformis,* and *Hypnea valentiae* were tested against *Mycobacterim tuberculosis* (H37Rv strain, SIT777, SIT26, SIT73 strain) using the REMA [(Rakhmawatie et al., 2019; Solanki et al., 2023)](https://paperpile.com/c/T8ttX5/7LD4+llXr)

## Statistical analysis

The experiments were did in triplicate assay to obtain standard error mean ± values. One-Way ANOVA was performed to validate the p value of significance where p>0.5 was considered significant(Chehelgerdi et al., 2023). SPSS package was used for One way ANOVA.

# Results

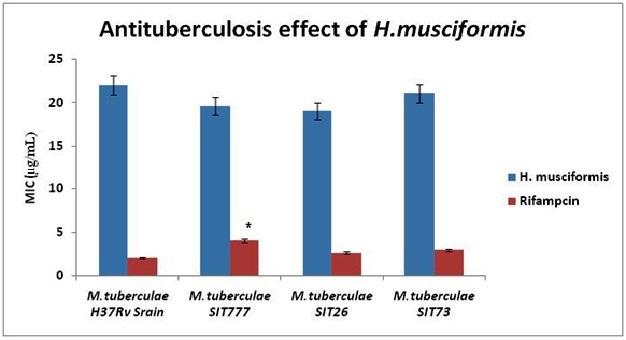
## Anti-tuberculosis effect of *H.flagelliformis*

*H.flagelliformis* extract showed significant antitubercular effect against *M.tuberculae* strains of H37Rv, SIT777, SIT26, and SIT73 at minimum inhibitory concentrations of 16, 18.2, 20, and 15.2 µg/mL as IC50 value when compared to that of standard Rifampicin drug which showed MIC value at 2,4, 2.6 and 2.9 µg/mL. When compared to standard Rifampcin drug *H.flagelliformis* exhibited significant antitubercular effect (Figure.1).\*p>0.5 value of significance.

**Figure.2:** Anti-tuberculosis effect of *H.flagelliformis*

## Anti-tuberculosis effect of *H. musciformis*

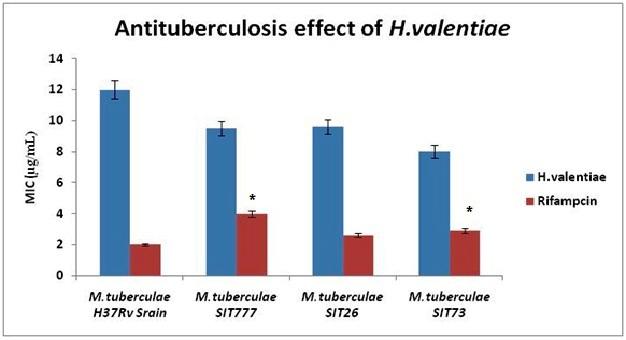
*H.musciformis* extract showed significant antitubercular effect against *M.tuberculae* strains of H37Rv, SIT777, SIT26, and SIT73 at minimum inhibitory concentrations of 22, 19.6, 19, and 21.02 µg/mL as IC50 value when compared to that of standard Rifampicin drug which showed MIC value at 2,4, 2.6 and 2.9 µg/mL. When compared to standard Rifampcin drug *H.musciformis* exhibited moderate antitubercular effect (Figure.2). \*p>0.5 value of significance.



**Figure.2:** Anti-tuberculosis effect of *H. musciformis*

## Anti-tuberculosis effect of *H. valentiae*

*H.valentiae* extract showed significant anti-tubercular effect against *M.tuberculae* strains of H37Rv, SIT777, SIT26, and SIT73 at minimum inhibitory concentrations of 12, 9.5, 9.6, and 8.01 µg/mL as IC50 value when compared to that of standard Rifampicin drug which showed MIC value at 2,4, 2.6 and 2.9 µg/mL. When compared to standard Rifampcin drug *H.valentiae* exhibited significant antitubercular effect (Figure.3). \*p>0.5 value of significance.



**Figure.3:** Anti-tuberculosis effect of *H.valentiae*

# Discussion

The present study emphasizes the antitubercular effect of three different algal extract of *Hypnea flagelliformis*, *H. musciformis,* and *Hypnea valentiae.* The results revealed that *Hypnea flagelliformis* and *Hypnea valentiae* has significant antitubercular effect than *H. musciformis. H.valentiae* extract showed significant antitubercular effect against *M.tuberculae* strains of H37Rv, SIT777, SIT26, and SIT73 at minimum inhibitory concentrations of 12, 9.5, 9.6, and 8.01 µg/mL and *H.flagelliformis* extract showed significant antitubercular effect against *M.tuberculae* strains of H37Rv, SIT777, SIT26, and SIT73 at minimum inhibitory concentrations of 16, 18.2, 20, and 15.2 µg/mL.

Currently, a variety of medications are used to treat TB [(Merchant et al., 2025)](https://paperpile.com/c/T8ttX5/BJ2e). Hepatotoxicity and the emergence of medication resistance are two main negative effects of this combo therapy [(*Anti-Inflammatory Potential Mouthwash Formulated Using Clove Ginger Mediated Zinc Oxide Nanoparticles: Vitro Study*, n.d.; Chokkattu et al., 2023; Muthuswamy Pandian et al., 2022)](https://paperpile.com/c/T8ttX5/fAaI+JwkH+7N5w). Medical plants are thought to be possible anti-tuberculosis compounds that can be used alone or in combination with the present anti-TB treatments to avoid toxicity and decrease ineffectiveness [(Tesso & König, 2004)](https://paperpile.com/c/T8ttX5/enbs). In this study, antimycobacterial activity of crude extract of three different *Hypnea sp* active crude extract was investigated [(Adel et al., 2023; Laghari et al., 2023; Subramanian & Harikrishnan, 2023)](https://paperpile.com/c/T8ttX5/jHOy+Vb8B+Y2eI).

*O. integrifolia* aerial parts were used to isolate and report the compounds otostegin A, otostegin B, 15-epi-otostegin B, preleoheterin, leoheterin, and related compounds such as ballonigrin, vulgarol, and 8-O-acetylharpagide (Saadh et al., 2024). Additionally, the essential oil and chloroform extract of air-dried leaves of *O. integrifolia* contained monoter [(Degu et al., 2012; Yusuf et al., 2012)](https://paperpile.com/c/T8ttX5/lphV+fYGW). Phytochemical screening study report indicated that saponins, glycosides and tannins, which are known to be bioactive purgative principles were present in V. amygdalina extract. Flavonoids are also present in the plant that possess antioxidant activity and may play a beneficial role in cancer prevention and offer some protection against diabetes and atherosclerosis.

# Conclusion

Three different seaweed extracts of *Hypnea flagelliformis*, *H. musciformis,* and *Hypnea valentiae* were evaluated for antitubercular effect through REMA invitro methods. Out of the threeextract *Hypnea flagelliformis* and *Hypnea valentiae* has significant antitubercular effect when compared to the standard drug Rifampcin which is validated through preliminary experimental results. Especially further research on *Hypnea valentiae* will lead to the isolation of drug candidates for advanced antitubercular drug research.

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