

Antimicrobial Activity of Fermented *Moringa Oleifera* Leaves Extracts Against *Salmonella Typhi* and *Bacillus Subtilis*

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Structured Abstract

Background: Antibiotic resistance (AR) that significantly impacts public health has accelerated the emergence of discovering active antimicrobial agents in natural sources since current antibiotics are less effective in treating infections against pathogens. As *M. oleifera* has been regarded as one of plants with the greatest reservoirs of phytochemicals, the extracts from *M. oleifera* leaves have attracted researchers to find novel and active metabolites. However, the extraction of *M. oleifera* leaf derivatives remains the crucial element in obtaining enhanced yields. Limitations in conventional extraction methods, like high solvent consumption have led to advancements in greener extraction methods such as microbial fermentation using LAB have improved efficiency and compound yield. Therefore, this study aims to develop fermented derivatives of *M. oleifera* leaf extract through single-strain and co-culture fermentation using *Lactobacillus acidophilus*, *Lactobacillus plantarum*, and *Lactobacillus casei Shirota* and to assess the antibacterial efficacy of fermented *M. oleifera* leaf extract derivatives against *Bacillus subtilis* and *Salmonella typhi*. These extracts are believed to possess antimicrobial activity against various pathogens.

Methods: The *M. oleifera* leaves powder was extracted using single-culture and co-culture of *L. acidophilus* 314, *L. plantarum* 8014, and *Lc Shirota* using fermentation process. The total of 7 derivatives prepared were fermented for 48 hours at 37 C in incubator shaker, filtered twice and freeze dried. The antibacterial activity of 7 extracts of fermented *M. oleifera* leaves were tested using agar well diffusion assay.

Results: The present study indicates that *B. subtilis* is more susceptible to the extract than *S. typhi*. The antimicrobial activity against *S. typhi* with the diameter of the inhibition zone sizes within the range of 11.0 ± 1.2 to 13.0 ± 1.4 mm and *B. subtilis* within the range of 7.7 ± 5.4 to 18.0 ± 0.8 mm.

Conclusion: In conclusion, the findings of this study indicated that there is considerable potential in extracting natural dyes from diverse plant sources, thereby offering long term environmental advantages. the fermented extract of *M. oleifera* leaf using different *Lactobacillus spp.* shows antibacterial activity, which may contribute to antibacterial efficacy, especially towards Gram-negative bacteria.

Keywords: Antimicrobial Activity, Fermentation, *Moringa oleifera* leaves extract, *Salmonella typhi*, *Bacillus subtilis*.

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