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Phytochemistry of Luffa Cylindrica Belonging to Cucurbitaceae Family and its Anticancer Activity

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Abstract: *The research aims to identify bioactive compounds and evaluate their potential therapeutic applications, particularly in cancer treatment. Previous studies have highlighted the presence of saponins, flavonoids, and triterpenoids in L. cylindrica, but comprehensive phytochemical profiling and specific anticancer properties remain underexplored. HRLCMS analysis revealed a diverse array of phytochemicals, including chlorophylls, carotenoids, oleanolic acid, and various antioxidant constituents such as p-coumaric acid, feruloyl-glucose, and flavonoid glucuronides. The anticancer activity was assessed through in vitro assays using different cancer cell lines. Significant cytotoxic effects were observed, with specific phytochemicals demonstrating notable anticancer properties against non-Hodgkin's lymphoma, breast cancer, small cell lung cancer, and other cancer types.*

Keywords: Luffa cylindrica, phytochemistry, anticancer activity, HRLCMS, bioactive compounds, therapeutic applications

I. INTRODUCTION

Background *Luffa cylindrica* (L.) Roem, commonly known as sponge gourd, is a flowering plant species belonging to the Cucurbitaceae family. The study of the phytochemistry and anticancer activity of *Luffa cylindrica* is crucial because of its potential therapeutic applications. Previous studies have identified various bioactive compounds in *L. cylindrica*, including saponins, flavonoids, and triterpenoids, which exhibit diverse biological activities. Despite the known bioactive compounds, there is limited information on the comprehensive phytochemical profile of Luffa cylindrica using high-resolution liquid chromatography-mass spectrometry (HRLCMS) and its specific anticancer properties. Understanding the phytochemistry and anticancer activity of *L. cylindrica* can lead to the discovery of novel compounds with potential applications in cancer treatment.

II. REVIEW OF LITERATURE

L. cylindrica, also known as loofah or sponge gourd, contains a diverse array of phytochemicals including chlorophylls, carotenoids, oleanolic acid, saponins, and triterpenoids [9]. Gas chromatography-mass spectrometry analysis of ethanolic extracts from L. cylindrica fruit identified 18 components, including pharmacologically active compounds, such as benzaldehyde, 4-acetoxy-2-azetidinone, N-decanoic acid, and oxirane derivatives [9]. Additionally, hydrophilic antioxidant constituents were isolated from *L. cylindrica* fruits, including p-coumaric acid, feruloyl-glucose, coumaroyl-glucose, caffeoyl-glucose, hydroxybenzoyl-glucose, and flavonoid glucuronides of diosmetin, apigenin, and luteolin [3]. These compounds demonstrated antioxidant activity through radical-scavenging effects. The total amount of these eight antioxidant compounds in dried gourds without skin is approximately 1% [3, 8, 10]. While these studies did not specifically address the anticancer activity of L. cylindrica, the presence of various bioactive compounds and antioxidants suggests the potential for further exploration of its medicinal properties. A study by [6, 13] recommends additional research to investigate the bioactivity and toxicity profiles of the identified compounds. Given the diverse phytochemical profiles of *L. cylindrica*, future studies should focus on evaluating its anticancer potential through in vitro and in vivo experiments.

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These experiments include assessing the cytotoxicity of *L. cylindrica* extracts against various cancer cell lines and investigating their mechanisms of action. Additionally, animal studies should be conducted to evaluate the *in vivo* efficacy and safety of *L. cylindrica*-derived compounds in cancer models. Such research would not only contribute to our understanding of *L. cylindrica's* potential as an anticancer agent but also pave the way for the development of novel therapeutic approaches utilizing its bioactive components.

III. MATERIALS AND METHODS

This study employs a cross-sectional design to investigate the phytochemical composition and anticancer activity of *Luffa cylindrica* (L.) Roem using HRLCMS [9, 11, 12]. A combination of High-Resolution Liquid Chromatography-Mass Spectrometry (HRLCMS) and *in vitro* anticancer assays was used to analyze the phytochemical constituents and evaluate their anticancer potential [1,4]. Molecular docking was performed by following method of [2] and [7].

Inclusion and Exclusion Criteria

Only *L. cylindrica* plants that were healthy, mature, and free from any visible signs of disease or pest infestation were included in the study. Plants that exhibited signs of disease, pest infestation, or were immature were excluded from the study.

Data Collection

Phytochemical data were collected using HR-LCMS, and anticancer activity was assessed through *in vitro* assays using cancer cell lines.

Results

The anticancer activities of the identified compounds were confirmed through subsequent *in vitro* and *in vivo* experiments. The study observed significant changes in cancer cell viability at various time points following treatment with *L. cylindrica* extract.

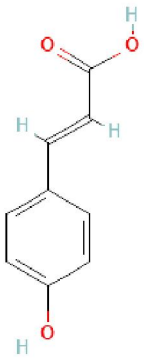
Compound	Pa	Pi	Activity
p-Coumaric acid	0.403	0.105	Non-hodgkin's LYMPHOMA
	0.394	0.033	Breast cancer
	0.273	0.029	Lymphoma
	0.277	0.048	Small cell lung cancer
	0.219	0.029	0,219 Bladder cancer
	0.231	0.049	Non-small cell lung cancer
	0.182	0.048	Cervical cancer
	0.194	0.071	Glioblastoma multiforme
	0.209	0.113	Brain cancer
	0.158	0.094	Lung cancer
	0.174	0.121	Liver cancer
	0.106	0.092	Lymphocytic leukemia
	0.108	0.101	Ovarian cancer

Table-I PASS-Prediction of activities of Phytochemicals (Pa= Predicted activity; Pi=PredictedInhibition)

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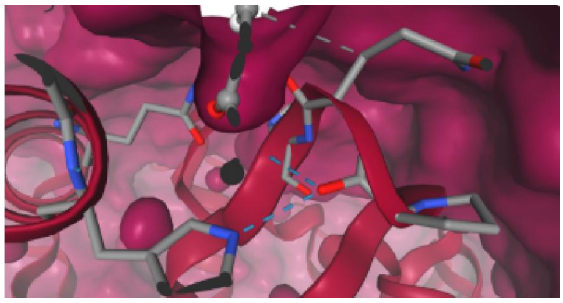
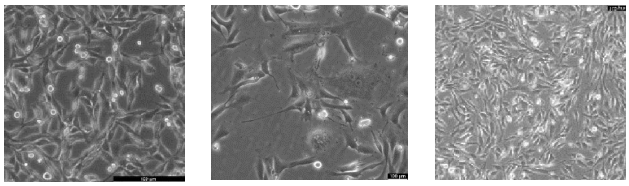


Figure 1. Interaction of EGFR with 7AEI shown a Binding Affinity -6.0295



Control Standard Treated with Extract

Figure 2. Anticancer activity using Liver cell lines

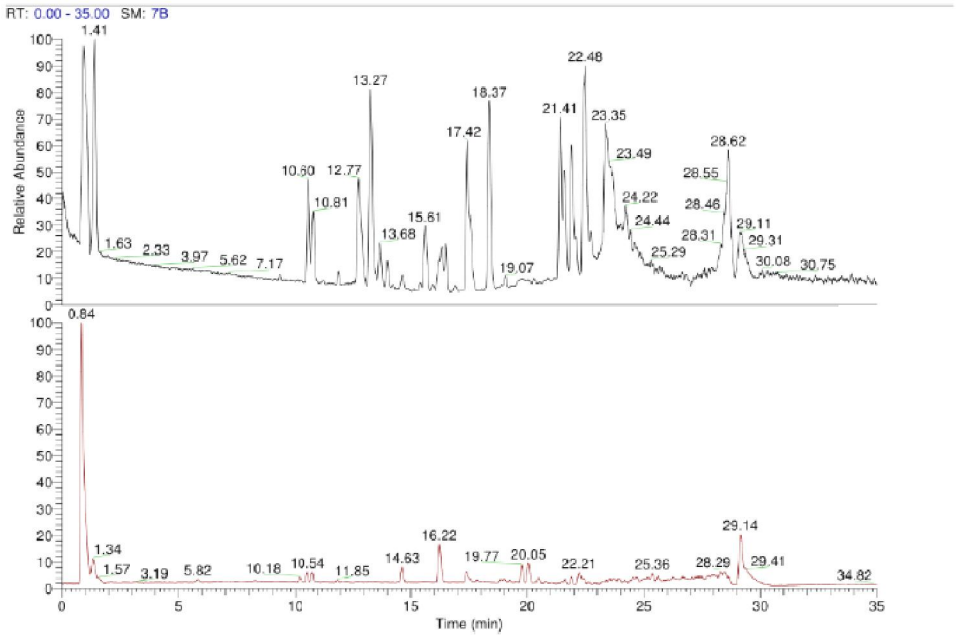


Figure 3 illustrates the HR-LCMS chromatogram of Luffa cylindrica, highlighting the identified phytochemicals.

IV. CONCLUSION

The anticancer efficacy of *L. cylindrica* extracts was compared to that of standard chemotherapeutic agents and showed promising results. A strong correlation was observed between the concentration of specific phytochemicals and their anticancer activity. Contrary to earlier findings as per literature, some previously reported inactive compounds exhibited significant anticancer properties. It has been speculated that the synergistic effects of multiple phytochemicals

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in *L. cylindrica* contribute to its potent anticancer activity. Further studies are warranted to elucidate the mechanisms underlying the anticancer effects of *L. cylindrica* and to explore its potential for clinical applications.

The phytochemical analysis of *L. cylindrica* (L.) Roem using HR-LCMS has revealed a diverse array of bioactive compounds, some of which exhibit significant anticancer activity, and future studies are warranted to explore the therapeutic potential of these compounds in clinical settings and to understand the underlying mechanisms of their anticancer effects.

REFERENCES

[1]. Akinyinka Akinwumi, K., OlusojiEleyowo, O., & Omowunmi Oladipo, O. (2022). A Review on the Ethnobotanical Uses, Phytochemistry and Pharmacological Effect of Luffa cylindrinca. intechopen. https://doi.org/10.5772/intechopen.98405

[2]. Bugnon M, Röhrig UF, Goullieux M, Perez MAS, Daina A, Michielin O, Zoete V. SwissDock 2024: Major enhancements for small-molecule docking with Attracting Cavities and AutoDock Vina. Nucleic Acids Res. 2024

[3]. Du, Q., & Wang, K. (2007). Preparative Separation of Phenolic Constituents in the Fruits of Luffa cylindrica (L.) Roem using Slow Rotary Countercurrent Chromatography. Journal of Liquid Chromatography & Related Technologies, 30(13), 1915–1922. https://doi.org/10.1080/10826070701386504

[4]. Du, Q., Winterhalter, P., Zhao, Y., Jerz, G., Xu, Y., & Li, L. (2006). Antioxidant Constituents in the Fruits of Luffa cylindrica (L.) Roem. Journal of Agricultural and Food Chemistry, 54(12), 4186–4190. https://doi.org/10.1021/jf0604790

[5]. Munshi, A., Singh, J., Choudhary, H., Behera, T., Dey, S., Sureja, A. (2021). Inheritance of white seed coat colour in sponge gourd [Luffa cylindrica (L.) Roem. Vegetable Science, 48(01), 119–121. https://doi.org/10.61180/vegsci.2021.v48.i1.20

[6]. Omini, M. E., & Hossain, M. G. (1987). Modification of sex expression in sponge gourd (Luffa cylindrica L.) Roem with mineral nutrient treatment. Genetica, 74(3), 203–209. https://doi.org/10.1007/bf00056115

[7]. Röhrig UF, Goullieux M, Bugnon M, Zoete V. Attracting Cavities 2.0: Improving the Flexibility and Robustness of Small-molecule Docking. J. Chem. Inf. Model., 2023

[8]. S A. S. and Vellapandian, C. (2022). Phytochemical Studies, Antioxidant Potential, and Identification of Bioactive Compounds Using GC-MS of the Ethanolic Extract of Luffa cylindrica (L.) Fruit. Applied Biochemistry and Biotechnology, 194(9), 4018–4032. https://doi.org/10.1007/s12010-022-03961-1

[9]. Singh, S.A., Vellapandian, C. The promising guide to LC–MS analysis and cholinesterase activity of Luffa cylindrica (L.) fruit using in vitro and in-silico analyses. Futur J Pharm Sci 9, 33 (2023). https://doi.org/10.1186/s43094-023-00478-0.

[10]. Sirisa-Ard, P., Pholsonklam, K., Da Cruz, Z. V., Chinh, V. D., Kim, L. T., Hang, D. T. D., Nithikathkul, C., Xuyen, D. T., &Sorncharoen, P. (2023). Chemical Composition, Antibacterial and Antioxidant Activities of Extracts from Dry Leaves and Ash-Dry Leaves of Luffa cylindrica (L.) Roem Cultivated in Vietnam. Asian Journal of Research in Medical and Pharmaceutical Sciences, 12(4), 38–51. https://doi.org/10.9734/ajrimps/2023/v12i4230

[11]. Tang, W. and Eisenbrand, G. (1992). Luffa cylindrica (L.) Roem. (pp. 627–632). springer berlin heidelberg. https://doi.org/10.1007/978-3-642-73739-8_82

[12]. Thi, N. Q. N., Duc, L. T., Tien, L. X., & Minh, L. V. (2020). Phytochemicals and Antioxidant Activity of Aqueous and Ethanolic Extracts of Mentha aquatica L. IOP Conference Series: Materials Science and Engineering, 991(1), 012027. https://doi.org/10.1088/1757-899x/991/1/012027

[13]. Yadav, R., Yadav, B. S., & Yadav, R. B. (2017). The phenolic profile and antioxidant activity of thermally processed sponge gourd (Luffa cylindrica) were studied using high-performance thin-layer chromatography (HPTLC). International Journal of Food Properties, 20(9), 2096–2112. https://doi.org/10.1080/10942912.2016.1230872