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In Vitro Characterization of *Lactiplantibacillus Plantarum* Strains: Probiotic Potential, Riboflavin Production, and Functional Properties

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Abstract

Lactiplantibacillus plantarum is commonly present in the gut microbiota of healthy individuals, as well as in a wide range of fermented foods and dairy products. Its well-documented probiotic potential, ability to produce bioactive compounds, and contribution to food preservation make it a promising candidate for functional food development. In this study, twenty-four lactic acid bacteria (LAB) isolates were obtained

from various samples. The isolates were identified using Matrix-Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry (MALDI-TOF MS), and all were showed a high similarity to the species *L. plantarum*. Their probiotic properties were evaluated through a series of in vitro assays. Among these, fourteen isolates exhibited tolerance to gastrointestinal tract conditions, cell surface properties, and significant antimicrobial activity. Only two strains showed substantial adhesion to mucins. In vitro screening showed a considerable antioxidant activity and efficient cholesterol assimilation, as well as β-galactosidase and proteolytic activities. All the strains exhibited remarkable levels of riboflavin (vitamin B_2) secretion, reaching concentrations of 1,646 ± 377.92 ng/mL. Most of the selected strains displayed safe antibiotic resistance profile and no pathogenic potential, suggesting that they are promising candidates for further investigation in human applications. Based on these findings, three *L. plantarum* strains were selected as promising candidates for in vivo applications in both food and human health. These strains exhibit potential not only as probiotics agents, but also as natural bioactive additives for nutritional fortification and food biopreservation.

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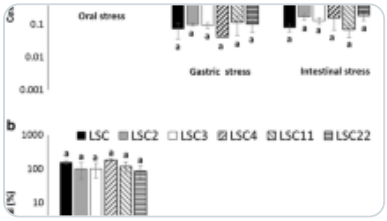
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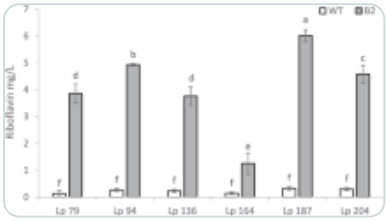
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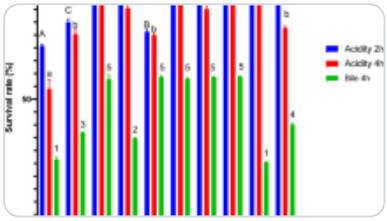
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Data Availability

The 16 S rRNA gene sequences of the *Lactiplantibacillus plantarum* strains analyzed in this study have been deposited in GenBank under the following accession numbers: L-S2 (PV730291), L-S7 (PV684233), and L-M2 (PV684232).

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Contributions

A.A.M. and E.G. conceived and designed the study. R.R., M.B., V.R., M.C., D.M., K.B., and S.T. performed the experiments and investigation. Formal analysis was conducted by R.R. R.R. drafted the original manuscript. A.A.M., S.H.F., M.S., H.O.H., E.G., and D.M. revised and edited the manuscript. A.A.M. supervised the study. All authors read and approved the final manuscript.

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Ethics declarations

Strain Availability

The strains used in this study are part of ongoing research within an Algerian PRFU program and are being actively used in further development toward a functional food application. Due to their current strategic importance and associated intellectual property considerations, they cannot be deposited in a public culture collection at this time. Upon

completion of the project and formalization of commercial protections, we intend to deposit these strains in a WDCM-recognized public culture collection.

Conflict of interest

The authors declare no conflicts of interest.

Ethics Approval

This study was conducted in accordance with the fundamental principles of the Declaration of Helsinki. Ethical approval could not be obtained because no ethics committee exists at the hospital. The research protocol did not involve any additional medical procedures beyond standard clinical practice, and all samples were anonymized prior to analysis.

Informed Consent

for stool sample collection was obtained from the parents of all participating newborns before sample collection.

Additional information

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