

**FUNCTIONAL DIVERSITY OF LACTIC ACID BACTERIA FROM  
FERMENTED RICE**

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**FUNCTIONAL DIVERSITY OF LACTIC ACID BACTERIA FROM  
FERMENTED RICE**

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BIOLOGICAL SCIENCES, COLLEGE OF SCIENCE AND  
TECHNOLOGY, COVENANT UNIVERSITY.**

**JULY, 2022.**

## **ACCEPTANCE**

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Sciences in Microbiology in the Department of Biological Science, College of Science and Technology, Covenant University, Ota, Nigeria

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## **DECLARATION**

**I, DANGO, GEORGE ZILPAH (20PCQ02198)** declare that this research was carried out by me under the supervision of Prof. Obinna C. Nwinyi` of the Department of Biological Science, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

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**Signature and Date**

## **CERTIFICATION**

We certify that this dissertation titled “**FUNCTIONAL DIVERSITY OF LACTIC ACID BACTERIA FROM FERMENTED RICE**” is an original research work carried out by **DANGO, GEORGE ZILPAH (20PCQ02198)** in the Department of Biological Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. Obinna C. Nwinyi. We have examined and found this work acceptable as part of the requirements for the award of Master of Science in Microbiology.

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## **DEDICATION**

I dedicate this work to Almighty God, for His grace, help, and strength throughout my dissertation.

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## LIST OF ABBREVIATIONS

ACE	Angiotensin converting enzyme
AMC	Antimicrobial compound
BLAST	Basic local alignment search tool
BSH	Bile salt hydrolase
CFS	Cell-free supernatant
EDTA	Ethylenediamine tetra acetic acid
EPS	Exopolysaccharides
GABA	Gamma-aminobutyric acid
GRAS	Generally regarded as safe
HHP	High hydrostatic pressure
HPP	High pressure processing
LAB	Lactic acid bacteria
LA	Lactic acid
MIC	Minimum inhibitory concentration
MRS	De Man, Rogosa and sharpe
M.W	Molecular weight
NCBI	National center for biotechnology information
NERICA	New Rice for Africa
NSLAB	Non-starter lactic acid bacteria
PBS	Phosphate buffer saline
SLAB	Starter lactic acid bacteria
TBC	Total bacteria count

## ABSTRACT

Rice is a staple food consumed in the world. Current statistics of rice consumption in Nigeria at December 2021/2022 is 6.900 million tonnes, and 6.950 million metric tonnes. Rice is known for its rich energy source, because of its carbohydrate content. Rice can also serve as a functional food when fermented, releasing microorganisms with health benefits and also for its bio-preservative purpose. The aim of this study was to determine the functional diversity of Lactic acid bacteria (LAB) isolated from fermented rice (*Oryza glaberrima*, and NERICA). In this study different varieties of raw rice were fermented. LAB genera were isolated from the fermented rice. The cultural, morphological, biochemical, and genotypic characterization of the LAB isolates were performed using standard methods. Proximate, Phytochemical and Phytate (antinutritional agent) analyses were carried out using Association of Analytical Methods (AOAC) to evaluate the nutritional content of fermented rice. Probiotic parameters were assessed (phenol, bile-salt, and pH) and different concentrations of 0.5 %, 1 %, pH 2, pH 5 and pH 7 (control). Safety assessment assay using haemolysis test and antibiotic susceptibility test (using gram-positive antibiotic disk) was carried out on the LAB isolates. Overlay, Kirby-Bauer agar well diffusion, and microtitre plates methods were used in the analyses of antibacterial activities for the LAB isolates, this was done to screen isolates for genotypic characterization, and bio-preservative test using bioactive packaging. Genotypic characterization revealed the three isolates to be *Lactiplantibacillus sp.* Strain DGZ\_2 ON954756, and two *Pediococcus sp.* DGZ-1 ON954755 and *Pediococcus sp.* DGZ 2 ON954757. The proximate, fermented rice showed Ash content ( $0.00 \pm 0.001$ ), moisture content  $0.05 \pm 0.02$ , carbohydrate ( $0.01 \pm 0.02$ ), protein ( $0.00 \pm 0.001$ ), crude fibre ( $0.00 \pm 0.01$ ) and fat contents ( $0.01 \pm 0.02$ ), phytochemicals present include Alkaloids, Quinone, Phenol, and Flavonoids. For the reduction in phytate content of two fermented rice sample, data obtained was reduction from  $4.46 \pm 0.02 - 3.47 \pm 0.08$  and  $5.45 \pm 0.02 - 4.46 \pm 0.01$ . For the probiotic parameter pH of the LAB isolates showed better survival rate at pH 7 than pH 2, pH 5 were average survival rate was noted. In 0.5% Bile salt and phenol concentration the *Lactobacillus* species had better survival at 80, 85, and 91 % bile salt and 81, 81, and 84 % for phenol. The antibiotic susceptibility assay showed that LAB isolates were susceptible to erythromycin (10 µg), ciprofloxacin (10 µg) and streptomycin (30 µg). The hemolytic data obtained revealed that two *Pediococcus sp* exhibited  $\alpha$ -haemolysis, only *Lactiplantibacillus sp.* exhibited  $\gamma$  haemolysis. LAB isolates showed inhibitory actions on foodborne pathogenic organism *Listeria monocytogenes* ATTC 78644 when overlay and micro-titre plate methods were used. For the shelf-life improvement of *Carica papaya L* when storage bags were treated with the three screened LAB isolates under 4 °C, the data obtained showed that *Carica papaya L* shelf life was extended when compared with the control stored at 4 °C. This study recommends fermented rice as a good functional food.

**Keywords:** *Fermented rice, Functional food, Lactic acid bacteria (LAB), Probiotics, and Shelf-life.*