

**[DEPARTMENT OF CHEMISTRY]
UNIVERSITY OF ENGINEERING AND TECHNOLOGY,
LAHORE**

No. Univ/Chem/233
Dated: 14.02.2024

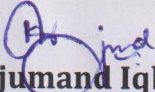
**HOLDING OF PUBLIC DEFENSE/
VIVA VOCE EXAMINATION OF PhD CANDIDATE**

Reference to the letter No. Exams/B/2024/5946 dated 13.02.2024.

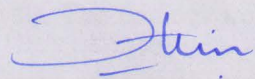
Mr. Muhammad Saleem, Registration No. 2019-R/2013-PhD-Chemistry-05, PhD Scholar of Chemistry Department under supervision of Dr. Arjumand Iqbal Durrani, Associate Professor has successfully fulfilled the requirements of publishing paper in impact factor international journal and positive reports from four external examiners (two from abroad and two from Pakistan) have been received with the recommendations that the viva voce examination be held to enable the candidate to defend his thesis.

Open defense and viva voce examination of Mr. Muhammad Saleem will be held on the same date and time mentioned below: -

Date: -	19.02.2024 (Monday)
Time: -	10.00am
Venue: -	Conference Room, Department of Chemistry
Thesis title: -	"Preparation and characterization of nutraceutical for the prevention and management of osteoporosis from industrial fruit wastes"


Dr. Arjumand Iqbal Durrani
Research Supervisor

Professor
Chemistry Department
University of Engineering
and Technology, Lahore


(DR. HUMAYUN AJAZ)
Chairman

Chairman
Chemistry Department
University of Engineering &
Technology, Lahore

Copy to: -

1. The Dean Faculty of NSH & IS
2. The Controller Examinations
3. The Director ORIC
4. The Director KICS (for advertisement on UET website)
5. The Secretary to the Vice-Chancellor
6. The External Examiners
7. The Student Concerned
8. The Notice Board

ABSTRACT

Osteoporosis is a condition which is characterized by a marked decrease in bone density, rendering bones more vulnerable to fractures. One of the major modifiable factors that affect osteoporosis is the availability of calcium and antioxidant compounds. The current research aimed at designing a nutraceutical that could act as an economical and easily available source of calcium and antioxidant compounds. The fruit peels of eleven fruits (biowaste) were selected as a raw material. The extracts were prepared in four different solvents viz ethanol, methanol, acetone, and water. The raw materials were tested for minerals by both traditional diacid method and ultrasonic-assisted methods. The antibacterial activity was determined by agar well diffusion assay. For antioxidant activity, the DPPH and FRAP assays were performed. Antioxidant compounds were quantified by colorimetric methods and were further confirmed by GC-MS. The results indicated that the highest calcium level was found in grapefruit while the highest antioxidant activity and antioxidant compounds were found in white pomegranate. Being a rich source of calcium and antioxidant compounds, the sonicated water extract of grapefruit peels was used to formulate a fortified bread as a nutraceutical. This fortified bread was then subjected to comprehensive characterization, including analysis of minerals, antibacterial and antioxidant assessments, quantification of antioxidant compounds, proximate analysis, physical evaluations, shelf-life, and cost analysis. The findings from the nutraceutical characterization revealed that the fortified bread can serve as an easily available and cost-effective source of essential minerals, particularly calcium, and antioxidant compounds crucial for maintaining bone health. Hence, this developed nutraceutical can be used as a daily source of calcium and antioxidants needed to control or prevent osteoporosis.