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Riboflavin-mediated Photodynamic Therapy Induces Cytotoxic Effects in A549 Lung Cancer Cells

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Cancer is a deadly disease that continues to claim the lives of its victims on a global scale. Lung cancer, a prevalent and deadly malignancy, arises from the uncontrolled growth of cells within the lungs. Comprising of non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC), this disease poses significant challenges in diagnosis and treatment. Therefore, there is a dire need to develop and introduce innovative solutions to effectively eradicate the disease. Photodynamic therapy has promising therapeutic effects while causing minimal harm to healthy cells and tissues. In the pursuit of advancing cancer treatments, this study explores the therapeutic potential and impact of riboflavin, a natural photosensitizer, and photodynamic therapy (PDT) against A549 lung cancer cells. The cells were treated with riboflavin at variable concentrations and irradiated using a laser of wavelength 470 nm and a fluency of 5 J/cm2. Following a period of 24 hrs post-irradiation, the A549 lung cancer cells were analyzed using a range of biochemical assays, namely adenosine triphosphate (ATP) and lactate dehydrogenase (LDH) assays to determine half maximal inhibitory concentration (IC50). In addition, morphological analysis post-irradiation and localization studies were performed to determine where the drug localizes in the organelles using a range of organelle-specific trackers, including markers for mitochondria, lysosome, and the endoplasmic reticulum. Moreover, a reactive oxygen species (ROS) detection assay was also performed for ROS quantification as a result of PDT. Changes in cell viability and morphology were observed post-treatment, indicating the cytotoxic effects of riboflavin-mediated PDT on A549 lung cancer cells. These findings suggest that riboflavin-mediated PDT has potential as an anticancer treatment for lung cancer.

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Primary author: SEELETSE, Malefo Tshepiso (University of Johannesburg-Laser Research Centre)

Co-author: Prof. ABRAHAMSE, Heidi (University of Johannesburg-Laser Research Centre)

Presenter: SEELETSE, Malefo Tshepiso (University of Johannesburg-Laser Research Centre)

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