

Abstract

The Effects of Pesticides on the Bioenergetics of Intestinal Cells [†]

Giuseppe Leonardo Auditano ^{1,2}, Karolin Kullison ², Tuuli Kaambre ¹ and Kersti Tepp ^{1,*} 

¹ Laboratory of Chemical Biology, National Institute of Chemical Physics and Biophysics, Akadeemia Tee 23, 12618 Tallinn, Estonia; giuseppoleonardoauditano@outlook.it (G.L.A.); tuuli.kaambre@kbfi.ee (T.K.)

² Department of Chemistry and Biotechnology, School of Science, Tallinn University of Technology, Ehitajate Tee 5, 12618 Tallinn, Estonia; karolin.kullison@gmail.com

* Correspondence: kersti.tepp@kbfi.ee; Tel.: +372-56154632

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Colorectal cancer is considered the second most common type of cancer [1]. It is assumed for this type of cancer that environmental factors are more important than hereditary factors [2]. Pesticides present in our food can alter the metabolism of our intestinal cells, and this might be related to the potential impact on overall cellular metabolism. The aim of this project was to investigate whether the pesticides Glyphosate, Glyphosate-based Roundup, Boscalid, and NeemAzal alter the energy metabolism of human intestinal cells. The study analyses if prolonged exposure and different growth environments increase the sensitivity of Caco-2 cells to pesticides. The rate of oxygen consumption based on electron flow through individual respiratory chain complexes and the overall oxygen consumption rate of the respiratory chain were analyzed using the method of high-resolution respirometry. The results demonstrated that lower concentrations of pesticides, which do not affected cells in the short term, significantly decreased cell viability with prolonged use. The experiments also showed that, in a plasma-like medium, similar to physiological conditions, the toxic effect of pesticides is higher or equivalent to that observed in cells grown in a regular medium. Analysis of mitochondrial oxidative phosphorylation revealed a significant decrease in the oxygen consumption rate through the electron transport chain at concentrations reducing cell viability by 20% for all pesticides. At lower pesticide concentrations reducing viability by up to 10%, the effect was detectable only for Boscalid and Roundup. The results of the study confirm that commercially available pesticide Roundup, along with its accompanying additives, exhibits stronger toxic effects than the declared active ingredient Glyphosate alone. The results of the study indicate that low pesticide concentrations, which have no immediate impact, may exert toxic effects over a longer period, and this influence should be studied in a plasma-like medium.

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