

Cytotoxicity of Chemicals Present in Agricultural and Household products

ABSTRACT

People can be exposed to agricultural and household products, including daily exposure to multiple products from both fields at the same time. There are two essential ways by which people are exposed to the herbicidal agricultural commodities. The first way is the direct exposure, which occurs during the usage of these chemicals. Indeed, homeowners use greater volume of herbicides in their gardens than the recommended rate, so they are using more herbicides per hectare than farmers. This misuse increases the chance of the exposure to these chemicals. Therefore, the cytotoxicity of 'Once-a-year path weed' and Roundup (R-up), agricultural products, and their constituents on the human skin cells, HaCaT, was studied. Assessing the cytotoxicity of 24h treatment of both products and their components was determined using two extensively used assays, MTT and Crystal violet (CV) assays. 'Once-a-year path weed' showed a significant reduction in the cell viability ($p < 0.001$) of HaCaT at concentrations as low as 0.005% containing 30 μM amitrole, 29 μM ammonium thiocyanate and 22.3 μM simazine. However, this cytotoxicity was not driven by any of the active ingredients, amitrole and simazine, nor the surfactant, ammonium thiocyanate. Simazine showed a significant HaCaT killing at 223 μM , which is ten times the concentration in 0.005% of the commercial products. On the other hand, 0.05% R-up significantly killed ($p < 0.05$) almost half of the human skin cells, but its active ingredient, glyphosate was not toxic at even much higher concentrations. Polyethoxylated tallow amine (POEA) was the surfactant, and it seemed to be highly toxic at very low concentration (13.6 μM). Therefore, it is more likely to be the responsible of R-up cytotoxicity.

The second way of exposure is the indirect exposure, which can take place through food ingestion. Herbicides residues exceed the international tolerance levels in some livestock such as raw bovine milk

and farm animal tissues. Via food intake, herbicides residues could reach the blood stream, and it is more likely that they interact with other substances in the blood such as caffeine. Caffeine is the most consumed psychoactive substance because it is commonly and frequently consumed in many dietary sources. Nowadays, the consumption of the caffeine-containing beverages occupies a significant place in the national cultures for most nations of the world. Accordingly, the second part of this study was to measure the effect of caffeine on the cytotoxicity of the tested commercial products and their constituents on the blood cell line, WIL2-NS. Caffeine increases the toxicity of some chemicals, but that increase was not significant.