Children and smokers face pesticide danger

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Pesticides used in food, tobacco and marijuana production are placing children and smokers in potential risk, a study has found.

Farmers across the world use pesticides to keep bugs and weeds at bay during the growing process. However, this often means these potent chemicals find their way into our bodies and can build up over time. An analysis of data from the US suggests that children and smokers of tobacco are being exposed to the highest levels of pesticide residues.

The dangers are highlighted in a report from Irish data science and analytics company Creme Global, which was commissioned by emerging biotech company Microbide, based in Dublin, Ireland. The findings are due to be presented at the Predict Conference in Dublin, on 2nd October 2018. "If new pesticides could be developed that biodegrade and reduce these exposures we could certainly expect a significant reduction in exposure levels," suggests Giulia Vilone, who co-authored the Creme Global analysis.

The findings come amid mounting concerns about some specific pesticides, particularly the weed-killer glyphosate and the insecticide chlorpyrifos.

Despite the assurances of governmental safety agencies, many consumers remain greatly concerned about pesticide residues in their foods. The huge market for organic produce, even with its price premium, testifies to that concern.

In August 2018, a US court ordered chemicals giant Monsanto to pay US$289 million in damages to a school groundskeeper who said his cancer was a result of using Roundup weedkiller, which contains glyphosate as its active ingredient. Monsanto now plans to appeal the verdict. Moreover, recent research found significant levels of glyphosate in many breakfast foods aimed at children.

Also in August, a court ordered the US Environmental Protection Agency to ban the sale of the widely-used pesticide chlorpyrifos due to links with developmental disorders, including autism, and other medical concerns. This compound is already banned in the European Union.

Concerns about chlorpyrifos are validated and increased by a recent study showing that low doses can interfere with brain development in frogs. Lead author Sara McClelland of Duquesne University in Pittsburgh, PA, USA, concluded the study shows that chlorpyrifos affects vertebrate brain development, even at low doses.

The Creme Global analysis used models largely developed by the US Environmental Protection Agency and the chemical industry to estimate the exposure of people in the US to the most commonly used pesticides.

Children at risk

One concern is that children are being exposed to around twice the level of the studied pesticides compared to adults. This is due to the fact that their food consumption per unit body weight is more than twice that of adults. On average, children eat similar quantities to the typical adult, though their bodyweight is significantly lower. This takes the dietary exposure of children up to the level found in adults who also smoke tobacco.

The Creme Global analysis also suggests that tobacco smokers risk

exposure to pesticide residues at about twice the level of non-smokers. This is due to chemicals entering the body through the smoke.

Out of the ten chemicals analysed, the main exposure risk in children is to chlorpyrifos, a compound that is the focus of some of the most significant medical concerns.

Pesticide levels in the foods were taken from the publicly available US Pesticide Data Program, while dietary habits were gleaned from the US National Health and Nutrition Examination Survey. Focusing on five specific foods—tomatoes, apples, lettuce, strawberries and rice—the analysis covered about 15% of the total diet. The estimated exposures were far below regulatory limits, but Vilone and her colleague Iwona Hawryluk emphasise that overall exposure, including the remaining 85% of the diet, will be significantly higher than the totals found in the study.

Complex cocktail

The presence of pesticide residues in food, tobacco and other consumer products is not disputed, and governmental regulatory agencies set limits that they deem to be acceptable. However, these limits generally treat each compound in isolation, when in reality we all take in a complex cocktail of residues.

The regulatory limits also tend to reflect typical levels of consumption, whereas some people consume specific products at levels well in excess of the average intake. "The lack of complete data makes understanding the full picture very difficult," says Hawryluk, while highlighting some specific causes for concern.

An animal study at the University on Toulouse in France, published in June 2018, highlights the significance of the residue mixture to which we are exposed. Professor Laurence Gamet-Payrastre and his colleagues

exposed mice to a low dose cocktail of pesticide residues at levels chosen to model realistic human exposure. They observed troubling metabolic changes in the mice, including those promoting obesity, diabetes and abnormal sexual development. They claim their work is the first to observe such changes in response to a "common mixture of pesticides," suggesting studying individual pesticides in isolation could lead to problems being missed.

Marijuana

The Microbide-commissioned body of work that Creme Global conducted also included an investigation of data and data-gaps on pesticide residues in marijuana, which raises some specific issues due to both its wide-scale recreational use and ever-increasing interest in and adoption of marijuana-derived products in healthcare applications. Previous studies demonstrate that the pesticide residues present in cannabis transfer directly into the mainstream smoke and ultimately into the smoker's body via inhalation. The report includes sources suggesting that "pesticide residues present in marijuana are a particular danger", however, Creme Global did not have enough data to run quantitative analysis to support this conclusion.

In healthcare applications, marijuana products treat people already suffering from health problems, who are therefore more vulnerable to toxic chemicals. Recreational users, on the other hand, often smoke marijuana without any filters, meaning they have less protection from pesticide residues than with most tobacco cigarettes. Much of the marijuana crop comes from less regulated conditions than traditional crops.

New concepts in agriculture

These study findings are in line with previous work in the field. "The analysis conducted by Creme Global is a continuation of the advancement in using modelling in combination with real-world pesticide residue and food consumption data to produce refined yet conservative exposure assessments," says Jason Johnston, senior scientist at Bergeson & Campbell PC in Washington D.C., USA, who is a human health risk assessment specialist with extensive experience in pesticide regulatory issues. "Such modelling is essential to improving our understanding of the relative sources of potential pesticide exposures in children and adults."

The Creme Global analysis comes amid increasing scientific attention focused on the risks of pesticide residues in foods, and exposure to pesticides during their application. In a wide-ranging review entitled "Pesticides, the environment and food safety," Fernando Carvalho of the University of Lisbon, Portugal, emphasises the problems with current practice. "Future increase in food production must go along with the production of food with better quality and with less toxic contaminants," he concludes.

In a similar vein, Polyxeni Nicolopoulou-Stamati of the University of Athens, Greece, with co-authors, draws attention to research emphasizing that the regulatory "safe limits" of pesticides "may underestimate the real health risk as in the case of simultaneous exposure to two or more chemical substances, which occurs in real-life conditions and may have synergistic effects." The authors add that "pesticides residues have also been detected in human breast milk samples, and there are concerns about prenatal exposure and health effects in children." As the authors conclude, it is clear that there is an urgent need for a new concept in agriculture "based on a drastic reduction in the application of chemical pesticides."

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