

Human health risk assessment of pesticide mixtures

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Currently, farmers have a tendency to mix two or more pesticides. Exposure to mixed pesticides poses serious health risks. We carried out a consumers' health risk assessment and occupational exposure risk assessment to commonly-used pesticide mixtures, methamidophos (organophosphate), methomyl (carbamate), as well as pyrethroids pesticides (cypermethrin or flucythrinate). For consumers' health risk assessment, the median pesticide residue concentrations and the restrained levels in crops, fruits and vegetables were collected from reports published by Taiwan Agricultural Chemical and Toxicological Substances Research Institute. The non-carcinogenic risk index (hazard indexes, HIs) of methomyl but not methamidophos was less than 1. Using Monte Carlo Simulation, the 95% upper confidence limits of total HIs for methamidophos or four pesticides at the established tolerance levels were higher than 1. For occupational exposure risk assessment, the distributions of pesticide exposure were assessed based on personal sampling of 19 farmers who spray mixed pesticides (methomyl and cypermethrin or flucythrinate) in the field. All samples from air sampling tubes, skin patches, blood, and urine were analyzed by LC-MS/MS. The inhalation HIs for farmers were all less than 1. In contrast, some of the dermal HIs for farmers were greater than 1. The Monte Carlo simulation analysis revealed that the 95% confidence limits of total HIs for some of the farmers were greater than one. Farmers using hand-compressed air pump generally have lower inhalation HIs than those using tractor-mounted applicators, but skin exposure is opposite. While the analysis of pesticide levels in blood and urine revealed that the farmers using tractor-mounted applicators have significantly higher levels than those using hand-compressed air pump. We proposed to strengthen the control of methamidophos in order to protect the safety of consumers. Since long-term exposure to these mixed pesticides may have potential health risk, it is recommended to strengthen personal protective measures when spraying.

Keywords: health risk assessment, pesticides, methomyl, cypermethrin