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Editorial Open Access

Human Health Risk Assessment and Management of Pesticides

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Editorial

Pesticides are applied widely around the world to control or kill target living organisms such as pest, unwanted plant, and insects. Since pesticides can be transported almost everywhere in the surrounding environment such as air, soil, water, and living organisms, application of pesticides may cause many adverse effects on ecosystem and human beings due to their toxicology. Human can exposure to pesticides *via* inhalation, ingestion, and dermal contact. Management of pesticides as human health risk control is a worldwide problem due to the various usage, environmental ubiquity, various human exposure pathways, and complexed metabolism in human body.

Human health risk assessment for pesticides usually includes four steps: hazard identification, dose response assessment, exposure assessment, and risk characterization [1]. Hazard identification aims to identify if the pesticide will pose the adverse health effect on human, and describe specific forms and types of toxic effects (neurotoxicity, carcinogenicity, etc.) [2]. The hazard information of pesticides is mainly obtained by epidemiologic studies (human beings) and animal studies. Dose response assessment evaluates the quantitative relation between the dose and the toxic response. Dose-response curve is applied and quantified by animal study. For non-carcinogenic pesticides, threshold values such as no observed effects level (NOEL) and lowest observed effects level (LOEL) from animal studies are used to extrapolate the dose to human. For carcinogenic pesticides, there is no threshold value because carcinogens could have an effect at any dose, which is usually expressed as a linear dose-response curve and cancer risk slope factors are also developed for carcinogenic pesticides. Exposure assessment measures the magnitude, frequency and duration of exposure to a pesticide by a population, along with the sources, environmental pathways, exposure routes, and the uncertainties. Pesticide risk characterization integrates the information from hazard identification, dose response assessment, and exposure assessment to estimate the likelihood of adverse effects pesticides attributed in a population.

Disability-adjusted life year (DALY) is a metric which could be applied to estimate the burden of mortality and morbidity caused by pesticides. DALY converts the burdens imposed by all health issues into the single number, which is used to control risks by quantifying human health risks of pesticides and the cost-effectiveness. Fantke and Jolliet studied the human health impact of hundreds of pesticides by using life cycle impact assessment models and DALY estimations [3]. Human exposure to pesticides from crop residues was computed by life cycle assessment models, and human health risks by pesticides applied to the commonly consumed agricultural commodities were characterized and quantified.

Pesticide standard values in various environmental pathways have been promulgated by worldwide regulatory jurisdictions to control human health risk and are based on the risk assessment. Jennings and Li conducted the worldwide pesticide soil regulatory guidance values (RGVs) study by application of the human cancer and non-cancer risk models [4]. The results indicate that there is little agreement on soil RGVs and some of the standard values are too high to protect human health. It suggested that pesticide policy makers should formulate and rationalize the pesticide soil RGVs. Management of pesticides for the human health risk control needs to fully understand toxicity of pesticides. Since various types of pesticides are applied and exist in the environment [5], human may be exposed to complex mixtures of pesticides which toxic effects could be additive or even synergetic. However, there is few studies about toxic effects of pesticides mixtures on the human health. One of the challenges is that there are hundreds of pesticides registered to use currently around the world and it is difficult to conduct a study on all possible combinations of pesticides. One approach suggested by Kepner [6] is to prioritize the test on pesticides by highest possibility of combinations, for example, the most commonly used pesticides on agricultural commodities. It cannot quantify human health risks accurately and promulgate pesticide standard values comprehensively unless a better understanding of toxic effects of pesticides mixtures is made. Therefore, study on the toxic effects of pesticides mixtures is necessary and will benefit human health risk assessment and management of pesticides.

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