IMPROVING RISK ASSESSMENT OF VINEYARD MANCOZEB APPLICATORS BY INTEGRATING ENVIRONMENTAL AND BIOLOGICAL MONITORING RESULTS

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Background: Ethylene-bis-dithiocarbamate (EDBC) fungicides have been used for decades, and although they have a low acute toxicity, there have been reports of possible negative health effects. Due to the specificities of agriculture, it is necessary to perform real-life risk assessment to validate the pre-marketing results. Additionally, many authors have raised concerns about using fixed absorption coefficients, together with other generic estimates, in absorption assessment. Implications are especially severe in modeling efforts, as the estimated absorbed dose is the key variable.

Aim of the study: The aim of this study was to estimate the absorbed dose and risk using a fixed absorption coefficient and a first-order kinetics model and evaluate environmental and biological monitoring endpoints' potential for modeling purposes.

Methods: This study was carried out in 2011 in the Region of Lombardy (Italy). Environmental monitoring was done using the "patch" method and by collecting hand wash liquid, and biological monitoring was done by collecting 24-hour pre- and post-exposure urine samples. The determination of mancozeb and ETU in different samples (pads, hand wash, and urine) was done by liquid chromatography-mass spectrometry. Risk assessment was done by comparing the estimated absorbed dose to the Acceptable Operator Exposure Level (AOEL) and repeated after accounting for the duration of exposure. Suitability of different exposure variables for modeling purposes was assessed using Spearman correlation coefficients.

Results: 29 healthy male farmers applied mancozeb on 38 work-days. Median total absorbed dose was 3 ng/kg body weight. Expressed as risk, the median absorbed dose was more than 10,000 times lower than the AOEL. After accounting for the duration of exposure, hand dose was reduced by more than 80% and body dose by around 50%. In general, best correlations were seen between the total dose and body dose, and the 24-hour post-exposure ETU urine levels (with and without correction for creatinine). The total absorbed dose and body dose had correlation coefficients with 24-hour post exposure ETU levels of 0.67 and 0.66, respectively ($p<0.05$).

Short discussion/conclusions: Workers' exposure to mancozeb is significantly below the AOEL. Using a first-order kinetics model for dermal absorption led to a major decrease in the estimated absorbed dose. This reduction could play a crucial role when environmental and biological monitoring results are used for modeling purposes.