

2016 SCIENTIFIC REPORT



MINISTRY OF FOOD AND DRUG SAFETY

National Institute
of Food and Drug Safety Evaluation

Risk Assessment of Ethoprophos

Ethoprophos, a non-systemic organophosphorus pesticide and nematicide, is used on various crops including strawberry, banana, pepper, tomato, melon, cucumber, potato, sweet potato, sugar cane, orange, lemon, grapefruit, apple, and pear. In Korea, it was first registered in granule form in 1981, and its MRL is set at 0.005–0.02 mg/kg for 31 foodstuffs, e.g., oats and potato (MRLs for Pesticides in Foods, May 31, 2016).

The ADI of ethoprophos at 0.0004 mg/kg bw/day was established by applying the safety factor of 100 (differences between species and individual entities) to the NOAEL of 0.04 mg/kg bw/day drawn from chronic toxicity and carcinogenicity studies on rats carried out for two years. In addition, the NOAEL on the inhibited activation of acetylcholinesterase in the brain, obtained from a two-generation study on rats, was the same, i.e., 0.04 mg/kg bw/day.

The intake amount of ethoprophos was estimated based on an analysis of 2,082 samples of 52 foodstuffs in the Monitoring of Agricultural Products in Korea (2011–2015) by the National Institute of Food and Drug Safety Evaluation. The results showed that the concentration of ethoprophos was below the LOQ, and thus, the pesticide was not detected in any of the samples, excluding one (radish, 0.173 mg/kg). Concerning data lower than the LOQ, in case more than 60% of data were below the LOQ, estimation was made by applying 0 (non-detection) as the lower exposure limit or the LOQ (upper exposure limit), according to the “evaluation of low level contamination of foods” recommended by the WHO. Food consumption was calculated through SAS 9.4 using the tertiary food code data from the KNHANES conducted for five years (2010–2014). For the average weight of all age groups, 60 kg, the weight currently (as of 2016) applied for establishment and revision of pesticide residue standards, was used. Concerning the average weights of different age groups, the data

2016 SCIENTIFIC REPORT



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from KNHANES was used, applying 12.3 kg, 19.2 kg, 37.4 kg, 59.5 kg, 65 kg, and 58.3 kg to the 1–2 year group, 3–6 year group, 7–12 year group, 13–19 year group, 20–64 year group, and the group aged 65 years or older, respectively. Risk characterization was made by calculating the HI in consideration of the EDI calculated in the exposure assessment and the ADI, the safe level of human exposure.

In general, when HI is 1 or higher, the adverse effects of toxicity are expected, and when HI is lower than 1, adverse effects are not expected. The results of the risk assessment of ethoprophos in different age groups revealed HI between 0.001 (non-detection data, 0 applied) and 0.248 (non-detection data LOQ applied), as shown in the table below, and that its concentration is within the safe level of human exposure.

2016 SCIENTIFIC REPORT



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Table 1. ADI and HI of ethoprophos

Age	EDI (mg/person/day)		Average weight (kg)	EDI (mg/kg bw/day)		ADI (mg/kg bw/day)	HI	
	0	LOQ (mg/kg)		0	LOQ (mg/kg)		0	LOQ (mg/kg)
All	0.5×10^{-4}	2.5×10^{-3}	60	0.1×10^{-5}	0.4×10^{-4}	0.0004	0.002	0.103
1-2	0.1×10^{-4}	1.2×10^{-3}	12.3	0.1×10^{-5}	0.1×10^{-3}		0.002	0.248
3-6	0.2×10^{-4}	1.6×10^{-3}	19.2	0.1×10^{-5}	0.1×10^{-3}		0.002	0.207
7-12	0.2×10^{-4}	1.9×10^{-3}	37.4	0.1×10^{-5}	0.1×10^{-3}		0.002	0.128
13-19	0.3×10^{-4}	2.1×10^{-3}	59.5	0.1×10^{-5}	0.4×10^{-4}		0.001	0.089
20-64	0.1×10^{-3}	2.7×10^{-3}	65.0	0.1×10^{-5}	0.4×10^{-4}		0.002	0.103
≥ 65	0.1×10^{-3}	2.4×10^{-3}	58.3	0.1×10^{-5}	0.4×10^{-4}		0.003	0.104

Key words: Ethoprophos, Risk Assessment, Organophosphorus insecticide, ADI, Monitoring, Pesticide