

# Estimation on the Risk of Pesticide Exposure by Food Intake

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This study was carried out to evaluate TMDI(theoretical maximum daily intake) and EDI(estimated daily intake) for Korean by using MRLs, food intake, residue data, and correction factors, and compare with ADI(acceptable daily intake) in order to estimate the health risk based on the pesticide exposure.

## Experimental

The study was performed in four steps. In the first step, the data of pesticide residues in agricultural products were collected by multiresidue method(MRM) of Korean Food Code which was modified from CDFA MRM. In the second step, pesticides for risk study were selected by the residue data and identify the risk of pesticides. In the third step, for the assessment of risk exposure, TMDI was estimated from MRLs, food factors, and compared with ADI. And treated EDI was calculated and evaluated using pesticide residue data, food factor, and correction factors which result from the effectiveness of each culinary treatment (washing, peeling, steaming, boiling, and salting). Then, in the last step, the oncogenic risks of three pesticides used in Korea whose oncogenic potency(Q\*) was known were assessed from TMDI and treated EDI.

1st step : Analysis of pesticide residues of agricultural products

To analyze the large numbers of samples whose pesticide treatment history is usually unknown, we use analytical methods capable of simultaneously determining a number of pesticide residues. We have developed these multiresidue methods(MRMs), which can determine about 170 pesticides within five hours. Appendix A lists the 170 pesticides analyzed by this MRMs. Sample preparation, sample extraction, and clean-up procedure were performed by modifying the official method of analysis of Korean Food Code.

2nd step : pesticides selection and risk identification

From the residue data, the pesticides which could expose to the body by food intake were identified the risk. To assess the risk identification of the pesticides, toxicology database such as IRIS, TOXLINE were used and by the EPAs classification system for carcinogens, hazard identification of selected pesticides was carried out.

3rd step : Assessment of risk exposure

For the assess of risk exposure, TMDI was estimated from MRLs, food factors, and compared with ADI.

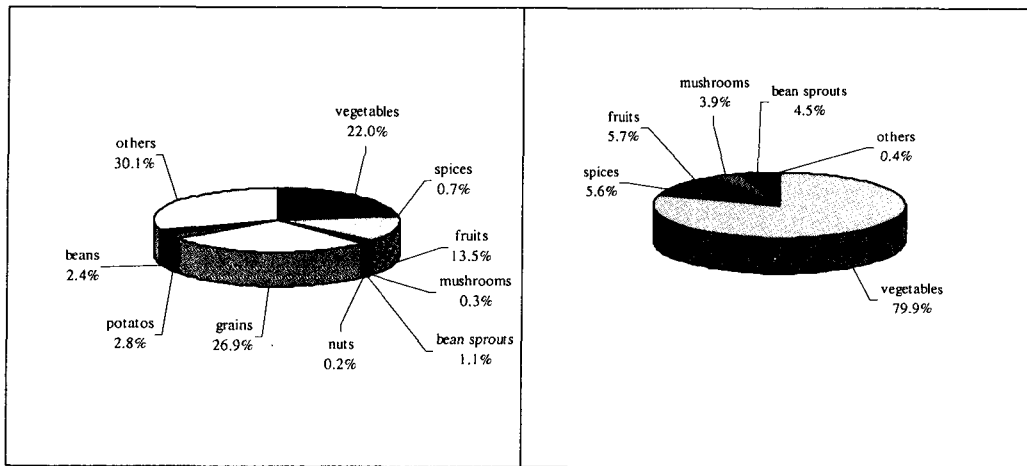
And non treated EDI and treated EDI were calculated and evaluated using pesticide residue data, food factor, and

correction factors which result from the effectiveness of each culinary treatment (washing, peeling, steaming, boiling, and salting).

4th step : Assess of oncogenicity

The oncogenic risks(excess tumor incidence for a 70-year human life span) of five pesticides used in Korea whose oncogenic potency(Q\*)(excess tumor incidence for a 70-year human life span per unit dose) was known were assessed from TMDI and treated EDI. The average body weight of Korean was assumed as 55kg.

### Results and discussion

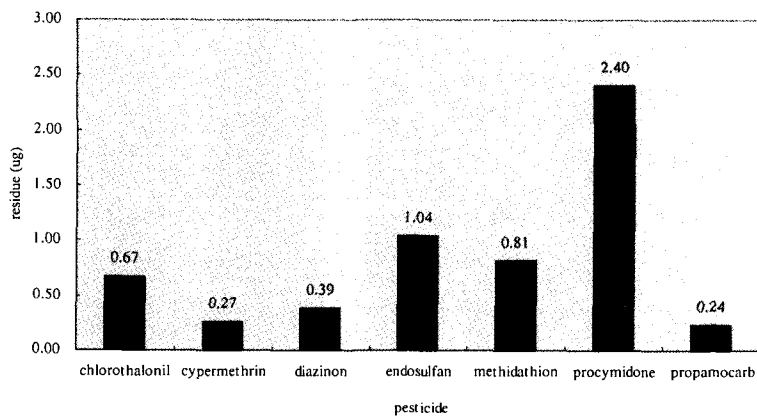


(a) food intake for each food group per capita per day (b) samples by pesticide residue analysis

Figure 1. Distribution of samples applied.

Table 1. Hazard identification of selected pesticides by EPA's classification system for carcinogens

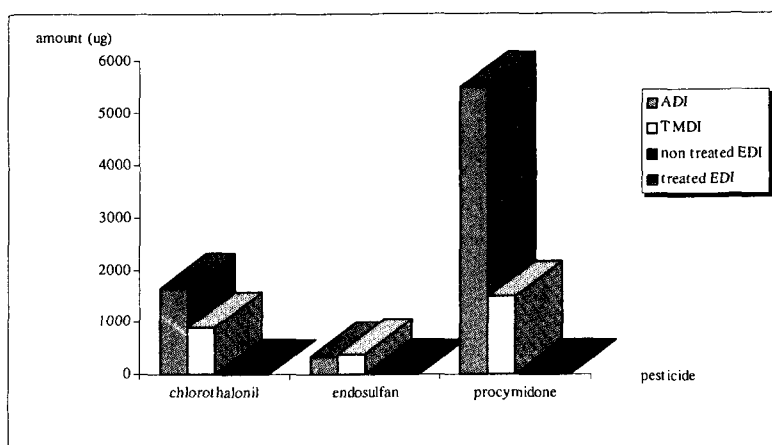
Classification	EPA classification system	pesticides
Carcinogenic chemicals	human carcinogen (A)	none
	probable human carcinogen (B)	alachlor, aldrin, chlorthalonil, dieldrin, folpet, carbofuran, heptachlor, heptachlor epoxide
	possible human carcinogen (C)	cypermethrin, dichlorvos, methidathion, permethrin, phosmet, phosphamidone, procymidone, triadimenol
Non-carcinogenic chemicals	not classifiable as to human carcinogenicity (D)	aldicarb, endrin
	evidence of not-carcinogenicity for humans (E)	captafol, carbofuran, chlorpyrifos, diazinon, EPN, lindane



**Figure 2. Major dietary intake of pesticides.**

**Table 2. Distribution of the ratio of TMDI to ADI according to Korean MRLs applied Korean food factors**

TMDI / ADI ratio (%)	No. of pesticides (%)
< 10	18 (6.87)
10 – 30	28 (10.69)
30 – 80	51 (19.47)
80 – 100	9 (3.44)
100 – 200	22 (8.40)
200 – 300	9 (3.44)
> 300	11 (4.20)
No ADI or MRL	114 (43.49)
<b>Total</b>	<b>262 (100.00)</b>



**Figure 3. Comparison of ADI, TMDI, EDIs in three major pesticides.**

Table 3. Estimation of dietary oncogenic risk from TMDI and EDI

Pesticide	Oncogenic potency		TMDI		EDI	
	tumors/mg/kg b.w/day	mg/kg b.w/day	Dietary oncogenic risk	mg/kg b.w/day	Dietary oncogenic risk	
cypermethrin	$1.9 \times 10^{-2}$	$1.7 \times 10^{-2}$	$3.3 \times 10^{-4}$	$1.2 \times 10^{-6}$	$2.2 \times 10^{-8}$	
chlorothalonil	$2.4 \times 10^{-2}$	$1.6 \times 10^{-2}$	$3.9 \times 10^{-4}$	$6.8 \times 10^{-6}$	$1.6 \times 10^{-7}$	
parathion	$1.8 \times 10^{-3}$	$2.4 \times 10^{-3}$	$4.4 \times 10^{-6}$	$3.0 \times 10^{-8}$	$5.1 \times 10^{-11}$	
Total		$7.3 \times 10^{-4}$		$1.8 \times 10^{-7}$		