Project number: 7171108
Project: Exposure assessment residues and contaminants
Project manager: J.D. van Klaveren MSc

Report 99.003 January 1999

AVERAGE TMDI AND THE DISTRIBUTION OF CALCULATED THEORETICAL PESTICIDE INTAKE IN THE NETHERLANDS

M.M.H. van Dooren-Flipsen MSc, J.D. van Klaveren MSc

The Ministry of Health, Welfare and Sports, Division Health Policy, Den Hague, The Netherlands assigned this project

Agricultural Research Department of the Netherlands (DLO-NL)
DLO-State Institute for Quality Control of Agricultural Products (RIKILT-DLO)
Department of Food Safety and Health
P.O. Box 230, NL-6700 AE Wageningen, The Netherlands
Telephone +31 317 475 400
Telefax +31 317 417 717

MAILING LIST

INTERNAL:
director
program managers
public realtions and secretary
library
authors
drs. D.G. Kloet
ir. G. van Donkersgoed
dr. M.J.B. Mengelers
A.H. Roos

EXTERNAL:
DLO Agricultural Research Department of The Netherlands
Ministry of Health, Welfare and Sports, Division Health Policy (drs. J.W. Dornseiffen, dr. W.H. van Eck, drs. N.B. Lucas Luijks, ir. R. Top)
Ministry of Agriculture, Nature Management and Fisheries, Department VVM (drs. P.H. Draaisma, ir. J.J.M. van den Heuvel, ir. A.F. Onneweer, drs. N.M.I. Scheidegger)
CTB Board of the Authorisation of Pesticides (ir. J.A. Garthoff, prof. dr. J.H. Koeman)
LUW Landbouw Universiteit Wageningen, Humane Voeding (prof. dr. ir. F. Kok)
RIVM National Institute of Public Health and the Environment (drs. P.H. van Hoeven, dr. G.J.A. Speijers)
Dutch National Food Consumption Survey Commission

ABSTRACT

Average TMDI and the distribution of calculated theoretical pesticide intake in the Netherlands
Gemiddelde TMDI en de verdeling van de berekende theoretische inname van bestrijdingsmiddelen in Nederland

Report 99.003 January 1999

M.M.H. van Dooren-Flipsen, J.D. van Klaveren
DLO-State Institute for Quality Control of Agricultural Products (RIKILT-DLO)
P.O. Box 230, 6700 AE Wageningen, The Netherlands

5 tables, 17 references, 25 pages, 5 appendices, 2 figures

Keywords: TMDI, dietary intake, pesticide residues, food safety

An important component in evaluating the risk from pesticides in our foods is estimating the dietary exposure from the pesticide. Generally the WHO methodology of calculating the Theoretical Maximum Daily Intake (TMDI) is used as a screening tool for assessing dietary intake of pesticide residues for long-term hazards. This method provides an average TMDI, but no information about the distribution of intake of the general population. For evaluating the relationship between the average (national) theoretical dietary intake and the distribution of intakes of the Dutch population calculations were carried out for totally thirteen pesticides (abamectin, aldicarb, captan, chlorpyrifos-methyl, dinocap, ethoxyquin, fenamiphos, glyphosate, heptachlor, iprodione, lindane, methidathion and methiocarb).
High positive correlation coefficients were found between the average National Theoretical Maximum Daily Intake (NTMDI) and the proportion of persons exceeding the ADI. An average NTMDI of 100% of the ADI, will result in approximately 35% of the Dutch population exceeding the ADI. The selected pesticides show that the number of individuals exceeding the ADI is very small when the calculated average NTMDI of a pesticide is smaller than 10% of the ADI. The theoretical maximum daily intake for high-intake consumers was about three times higher than intake of the 'average' Dutch consumer. It is emphasised that high intakes in this study are an overestimation of chronic exposure to a large extent, due to the utilisation of high residue levels (MRLs) and the short period of food recording. A more realistic estimate of the levels of pesticide residues in food is the Supervised Trial Median Residue Level (STMR). Under the assumption that the STMR is equal or lower than 30% of the MRL and taken into account the short period of food recording, it is suggested that an average NTMDI smaller than 150% of the ADI will relieve intake concern for the general Dutch population.
The average NTMDIs and the prevalence of ADI-exceeding varied greatly over different subgroups of the Dutch population. The highest intakes were observed among children in the youngest age groups. It is recommended to incorporate this vulnerable subgroup of the population in national model diets for chronic intake estimations.

CONTENT

		PAGE
ABSTRACT		1
1	INTRODUCTION	3
	Exposure assessment of pesticide residues	5
	Dietary exposure assessment procedures for pesticide residues	5
	Average TMDI and the distribution of dietary intake of the Dutch population	7
2	METHOD	8
	2.1 Selection of pesticides	8
	2.2 Theoretical dietary intake of pesticides	8
	2.2.1 Dutch national food consumption survey	8
	2.2.2 Conversion model Primary Agricultural Products	9
	2.2.3 Concentration levels in food commodities	10
	2.2.4 Theoretical dietary intake calculations at the individual level	10
3	RESULTS	12
	3.1 Selected pesticides	12
	3.2 Average NTMDI and exceeding of ADI	13
	3.3 Simulated residue content levels	15
	3.4 Subgroups of the population	18
4	DISCUSSION AND CONCLUSIONS	19
	Methodological considerations	19
	Selected pesticide	20
	Average NTMDI and exceeding of ADI	20
	Simulated residue content levels	21
	Distribution of intake and subgroups of the poulation	21
LITERATURE		23

APPENDIX I: Terminology risk analysis

APPENDIX II: National MRLs of the selected pesticide residues

APPENDIX III: Distribution of National Theoretical Maximum Daily Intake (NTMDI) for the Dutch population (n=6,218)

APPENDIX IV: Average theoretical daily intake (in % of ADI) and proportion of theoretical ADI-exceeding (%>ADI), calculated with proportionally lowered MRLs (10%-70% MRL) for different pesticides

APPENDIX V: Statistical values of the calculated NTMDIs for different subgroups of the Dutch population

1 INTRODUCTION

Exposure assessment of pesticide residues

Risk assessment is a process consisting of the following steps: (i) hazard identification, (ii) hazard characterisation, (iii) exposure assessment, and (iv) risk characterisation (appendix I).
At the international level, dietary exposure assessments have an important function to screen food chemical(s) intakes and identify those chemicals with a potential public health and safety concern. Toxicological harmonised standard setting is a process carried out by international organisations as the Codex Alimentarius, World Health Organisation (WHO), Food and Agricultural Organisation (FAO) and the European Community.
Prediction of pesticide residue intake in human diets is vital for approving the use of pesticides and for gaining official acceptance of pesticide residue levels which occur in food commodities in international trade.

Dietary exposure assessment procedures for pesticide residues

The WHO methodology for dietary exposure assessment of pesticide residues is described in "Guidelines for predicting dietary intake of pesticide residues" [WHO, 1989; WHO, 1997]. At the international level, the Theoretical Maximum Daily Intake (TMDI) is used as a screening tool for assessing dietary intake of pesticide residues for long-term hazards. The TMDI is calculated by multiplying the established or proposed Maximum Residue Levels (MRL) by various average daily per capita food consumption estimates for each food commodity based on the GEMS/Food Middle Eastern, Far Eastern, African, Latin American, and European-type diets and then summing the products, as given by:

$$\mathrm{TMDI} = \sum F_i \times \mathrm{MRL}_i$$

where

F_i = average regional/cultural food consumption for a given commodity
MRL_i = Maximum Residue Limit corresponding to that food commodity

Dimension TMDI and ADI:
TMDI mg pesticide residue/person/day
ADI mg pesticide residue/kg bw/day

The five regional diets are based on national FAO food balance sheets (FBS), which provide gross annual estimates of the national availability of food commodities.
In 1996 RIKILT-DLO developed a Dutch TMDI model [Dooren-Flipsen et al, 1996a]. For that purpose the average dietary intake of primary agricultural products was derived from an extensive database of actual consumption by individuals, the Dutch National Food Consumption Survey 1992

[Anonymous, 1994]. With this model a national TMDI (NTMDI) can be calculated on the basis of the Dutch food commodity diet. The Dutch Board for Authorisation of Pesticides (CTB) and the RIVM National Institute of Public Health and the Environment use this Dutch TMDI model for the Dutch registration of pesticides and the establishment of maximum residue limits of pesticide residues.
The TMDI is compared to the corresponding pesticide residue Acceptable Daily Intake (ADI), calculated for a 60 kg person and expressed as a percent of the ADI.
The TMDI is an overestimate of the true pesticide residue intake. If the TMDI does not exceed the ADI (<100% of ADI), it is highly unlikely that the ADI would be exceeded in practice. When the TMDI is higher than 100% of the ADI, more refined dietary intake predictions of pesticide residues are necessary to resolve exposure concern. The International Estimated Daily Intake (IEDI) and National Estimated Daily Intake (NEDI) is a more realistic prediction of the pesticide residue intake. For these calculations it is recommended to make use of all available relevant (inter)national information data to refine dietary intake estimates [WHO, 1997] (table 1). For calculating the IEDI, the following formula is used:

$$IEDI = \sum F_i \times STMR_i \times E_i \times P_i$$

where

F_i	=	average regional/cultural food consumption for a given food commodity
$STMR_i$	=	Supervised Trials Median Residue level for that food commodity
E_i	=	edible portion factor for that commodity
P_i	=	processing factor for that commodity

The IUPAC Commission on Agrochemicals and the Environment also recommended that the best available data should be used for dietary intake estimations of pesticide residues [Hamilton, 1997]. The median residue in the edible portion of the commodity in supervised trials (STMR) was chosen as the starting point for chronic dietary intake estimations.
Procedures for estimating acute dietary exposure to pesticide residues are still being developed. Both WHO/FAO and IUPAC give recommendations [Hamilton, 1997; WHO, 1997].

Table 1: Factors for refining estimates of residue levels for predicting long-term dietary intake of pesticide residues at the international and national level [WHO, 1997].

National and international	National
* Supervised Trial Median Residue levels (STMR), according to the residue definition * Residues in edible portions * Effects of processing and cooking on residue levels * Other known uses of the pesticide	* Proportion of crop or commodity treated * Proportion of crop or commodity produced domestically and imported * Monitoring and surveillance data * Total diet (market basket) studies * Food consumption data, including for subgroups of the population

Average TMDI and the distribution of dietary intake of the Dutch population

Generally the international long-term dietary exposure assessment do not provide information about the distribution of intake within the general population, because they use a single-point estimate of food consumption, the average. This method is not useful for evaluating the individual exposure to pesticide residues or for identifying subgroups of the population at risk.

There is a lack of understanding the association between average TMDI and the distribution of dietary intakes, especially with high levels of intakes. The WHO recommended to include relevant subgroups who may be more sensitive to certain toxic effects, such as children, pregnant women and the elderly. In addition possible risks to subgroups of the population which habitually consume greater quantities of individual foods should be considered [WHO, 1997]. Further the impact of more refined intake estimates, using generally factors that reduce the concentration levels (STMR, edible parts, processing/cooking) on the distribution of pesticide residue intake is not clear. For this, a large number of theoretical dietary intake calculations of a selected number of pesticides were carried out. The distribution of consumption levels from a large scale Dutch food consumption survey were combined with theoretical concentration levels in food commodities. For the determination of theoretical dietary residue intakes with reduced concentration levels in food commodities, various simulations were carried out.

Chapter 2 describes the method for selection of the pesticides, and applied data for estimating the theoretical dietary residue intake of the Dutch population. The results are given in chapter 3. Chapter 4 the results are discussed and conclusions are drawn.

2 METHOD

2.1 Selection of pesticides

To study the average theoretical dietary intake in relation to the distribution of dietary residue intake in the Netherlands first a number of pesticides are selected. For the selection of the pesticides criteria were set up.

Selection criteria in hierarchical order:

1) An Acceptable Daily Intake (ADI) is established by WHO (JMPR). The TMDI can be compared to the corresponding pesticide ADI and expressed as a percent of the ADI.
2) The total of selected pesticides have MRLs which cover a wide range of consumed agricultural products. Specific attention for those groups of agricultural products with specific pesticide use patterns like: fruit and fruiting vegetables, leafy vegetables, and cereals.
3) Include both fat and water soluble pesticides.
4) The total of selected pesticides give a reasonable range in reported average TMDI (in % of ADI).
5) Recent evaluation of toxicology and/or residue and analytical aspects of pesticide residue by JMPR.

2.2 Theoretical dietary intake of pesticides

Food consumption data of the Dutch National Food Consumption Survey and national MRLs in conjunction with the Conversion Model for Primary Agricultural Products are used in estimating the theoretical dietary intake of the selected pesticides to which the Dutch population is exposed through their diets.

2.2.1 Dutch national food consumption survey

The food consumption data used in this study are derived from the second Dutch National Food Consumption Survey 1992 (DNFCS). Respondents in this large-scale survey came from a representative sample of households with the main housekeeper younger than 75 years. A total of 6,218 people (2,203 households), aged 1-92 years, participated in the DNFCS-92. Information on food consumption was obtained using 2-day dietary records. Individual data represented two consecutive days. The recording days were distributed equally over the 7 days of the week, and over a whole year, holidays excluded. For each individual age, sex, body weight and a series of other characteristics were recorded. The methods and procedures used in dietary data collection are described in detail elsewhere [Hulshof et al, 1991; Anonymous, 1994]. For the present study the individual food consumption is derived from the average daily consumption over the 2 day dietary record period.

2.2.2 Conversion model Primary Agricultural Products

In the Netherlands, the government and agribusiness intensively monitor primary agricultural products for residues and contaminants. While (inter)national legislation provides standards for primary agricultural products, food consumption data relate to consumable products.

In 1994 the State Institute for Quality Control of Agricultural Products (RIKILT-DLO) developed a conversion model to unequivocally couple primary agricultural products and consumable foodstuffs [Dooren et al, 1996b, 1995]. With this 'recipe database' the food consumption data of the DNFCS-92 are transformed to hypothetical consumption data of raw agricultural products. Furthermore consumption figures for the individual components of primary agricultural products, milk fat, fish fat, beef fat and egg fat were derived.

In order to derive the individual Dutch consumption of primary agricultural products for theoretical intake calculations, specific definitions are set in the conversion model primary agricultural products (table 2). The constructed raw agricultural commodity food consumption database contains consumption figures of 6,218 individuals.

Table 2: Product definitions primary agricultural products for theoretical intake calculations.

vegetables	=	including shrink and waste amount
fruit	=	including peel, seed, stone, core and green waste amount
cereal	=	derived from the most important components of a grain which may be separately present in a food stuff (starch/flour, germ, bran)
milk	=	sum of casein, whey, milk fat, lactose and water amount present in foodstuffs

2.2.3 Concentration levels in food commodities

MRLs

For the risk evaluation of pesticides the prediction of dietary intake starts with a worst case scenario, the calculation of the Theoretical Maximum Daily Intake (TMDI). A TMDI is calculated with the maximum residue level (MRL). A MRL for pesticide residues is the maximum concentration of a pesticide residue (expressed as mg/kg) legally permitted in or on food commodities and animal feed. In this study the maximum limits for pesticide residues as stated in the Dutch Pesticide Law in the regulation of pesticide residues (May 1997) were applied. The Dutch MRLs of the different pesticide residues, which are used for the dietary intake estimations, are listed in appendix II. A MRL marked with an asterix (*) means that the pesticide may be or may not be used, leaving residues in food commodity above the limit of determination (LOD). In this study the MRLs established at or about the LOD for the group 'other' is set equal to zero. In case of specified agricultural products the MRL was set at the LOD.

Simulation of residue content levels

More refined predictions of dietary intake use all available and relevant data like edible parts, processing/cooking factors, and residue values of supervised trials. A rule of a thump is that MRLs are commonly about three times higher than Supervised Trail Median Residue (STMR) values [Eck van, 1995]. The IUPAC reported from a set of supervised residue field trials covering 22 crops and 10 pesticides the majority of 'median:maximum' values spread broadly from 0.1 to 0.7. The average 'median:maximum' value was 0.3 [Hamilton, 1997]. For the present study the concentration levels in food commodities are simulated according to these values. The established Dutch MRLs for a pesticide residue are reduced in terms of percentage, namely to 70%, 60%, 50%, 40%, 30%, 20% and 10% of the MRL. This type of analysis can indicate the influence of more refined calculations on the distribution of dietary intakes.

2.2.4 Theoretical dietary intake calculations at the individual level

For each pesticide residue, for each individual of the DNFCS the theoretical daily intake based on the 2 days was calculated by multiplying the amount of a consumed food commodity with the Dutch MRL (or reduced MRL) for that given commodity. In the case of several foods, food consumption estimates for each of the foods in the assessment are multiplied by the corresponding MRL and summed for each individual. In formula:

individual NTMDI	=	$\sum F_i \times MRL_i$
F_i	=	individual food consumption of a food commodity
MRL_i	=	national (reduced) Maximum Residue Limit for that given commodity

For calculating the individual intake per kg bw per day, the individual body weight, as reported in DNFCS-92, was used. The results of the theoretical dietary intake were compared with the Acceptable Daily Intake (of WHO), to estimate the percentage of population exceeding this safety limit. The variability among the individuals in the study population is computed with different measures of spread: standard deviation (SD), coefficient of variation (CV) and ratio 95th percentile intake:mean intake. The 95th percentile theoretical intake was defined as the upper level of dietary intake i.e. 95% of the population will have an intake equivalent to or lower than this level. This value is arbitrary, because the individual food consumption data represent a short period of dietary intake (2-day diet records). The underlying assumption is that intakes higher than the 95th percentile intake level are more likely to represent incidental than habitual intake.

To qualify possible risk groups NTMDI calculations were carried out for different age groups, men and women, pregnant women, vegetarians and immigrants of the Netherlands.

3 RESULTS

3.1 Selected pesticides

The selected pesticides for predicting dietary intake of the Dutch population are abamectin, aldicarb, captan, chlorpyrifos-methyl, dinocap, ethoxyquin, fenamiphos, glyphosate, heptachlor, iprodione, lindane, methidathion and methiocarb. For each of these pesticides an ADI was established by the WHO. MRLs are set for a wide range of agricultural products, including fruit (methidathion), fruiting vegetables (dinocap), cereals (chlorpyrifos-methyl) and leafy vegetables (iprodione). Lindane and heptachlor were selected because these organochlorine insecticides are stored in fatty tissues. The international calculated TMDIs of the 13 selected pesticides are in the range of 1 to 1237 percent of the ADI (see table 3).

Table 3: Selected pesticides for prediction of theoretical dietary intake.

Pesticide	ADI (mg/kg bw/day)	(group of) agricultural products	fat soluble	average TMDI in % of ADI*	JMPR evaluation year
	criteria 1	criteria 2	criteria 3	criteria 4	criteria 5
abamectin	0.002	aubergines, peppers, tomato		1-7	1997
aldicarb	0.003	citrus fruit, bananas, potatoes		10-80	1996
captan	0.1	different fruits and vegetables		2-43	1997
chlorpyrifos-methyl	0.01	particularly cereals		441	1994
dinocap	0.001	fruiting vegetables and apples		-	1992
ethoxyquin	0.06	pome fruit: apple, pear		-	1998
fenamiphos	0.0008	orange, grapes, potatoes, coffee		30-190	1997
glyphosate	0.3	wheat and soy bean		2-4	1997
heptachlor	0.0001	vegetable and animal fats	X	357	1994
iprodione	0.06	particularly leafy vegetables		30-80	1995
lindane	0.001 temporary	vegetable and animal fats	X	382-1237	1997
methidathion	0.001	particularly citrus fruit		200	1994
methiocarb	0.001	particularly lettuce		-	1988

* = range of TMDI values from calculations based on the five GEMS/Food diets: Middle Eastern, Far Eastern, African, Latin American, European diet.

3.2 Average NTMDI and exceeding of ADI

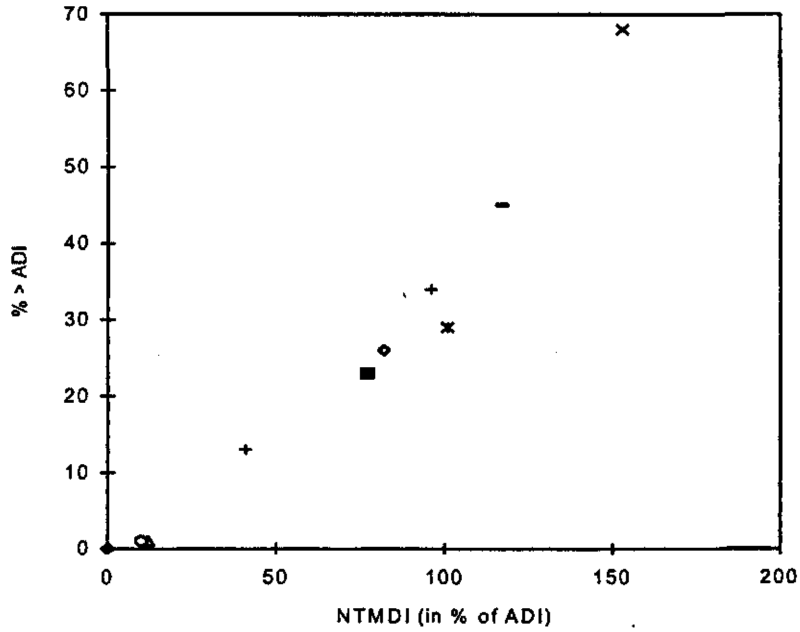
The average National Maximum Theoretical Daily Intake (NTMDI), expressed as a percentage of the corresponding ADI for the overall study population were estimated 0% for abamectin, 77% for aldicarb, 12% for captan, 153% for chlorpyrifos-methyl, 101% for dinocap, 10% for ethoxyquin, 96% for fenamiphos, 6% for glyphosate, 117% for heptachlor, 82% for iprodione, 910% for lindane, 455% for methidathion and 41% for methiocarb. In table 4 the calculated average NTMDI for the overall population (n=6,218) is given together with different measures of spread (standard deviation, coefficient of variation, ratio 95th:mean) and the proportion of persons exceeding the ADI.

Table 4: National Theoretical Maximum Daily Intake (NTMDI) of pesticide residues for the overall Dutch population, using Dutch National Food Consumption Survey-1992 and national MRLs.

Pesticide residue	International TMDI (% of ADI) JMPR evaluations	NTMDI (ug/day) mean ± SD	CV (%)	ratio 95th:mean	NTMDI (% of ADI) mean	Individuals exceeding ADI (%>ADI)
abamectin	1-7	0.55 ± 0.98	178	4.3	0	0
aldicarb	10-80	122 ± 80	66	2.2	77	23
captan	2-43	619 ± 510	82	2.4	12	1
chlorpyrifos-methyl	441	851 ± 487	57	2.1	153	68
dinocap	-	45 ± 64	142	3.3	101	29
ethoxyquin	-	276 ± 408	148	3.5	10	1
fenamiphos	30-190	42 ± 35	83	2.5	96	34
glyphosate	2-4	1150 ± 1406	122	3.4	6	0
heptachlor	357	6.2 ± 3.0	48	1.9	117	45
iprodione	30-80	2572 ± 2009	78	2.4	82	26
lindane	380-1200	492 ± 276	56	2.0	910	99
methidathion	200	244 ± 328	134	3.6	455	65
methiocarb	-	24.5 ± 43.6	178	4.5	41	13

Figure I shows the relation between average NTMDI and the proportion of population exceeding the ADI.

IA Y= 0.41X - 4.1 r=0.98 R^2=0.96 SE=4.9



IB Y= 0.11X + 14.4 r=0.87 R^2=0.75 SE=16.7

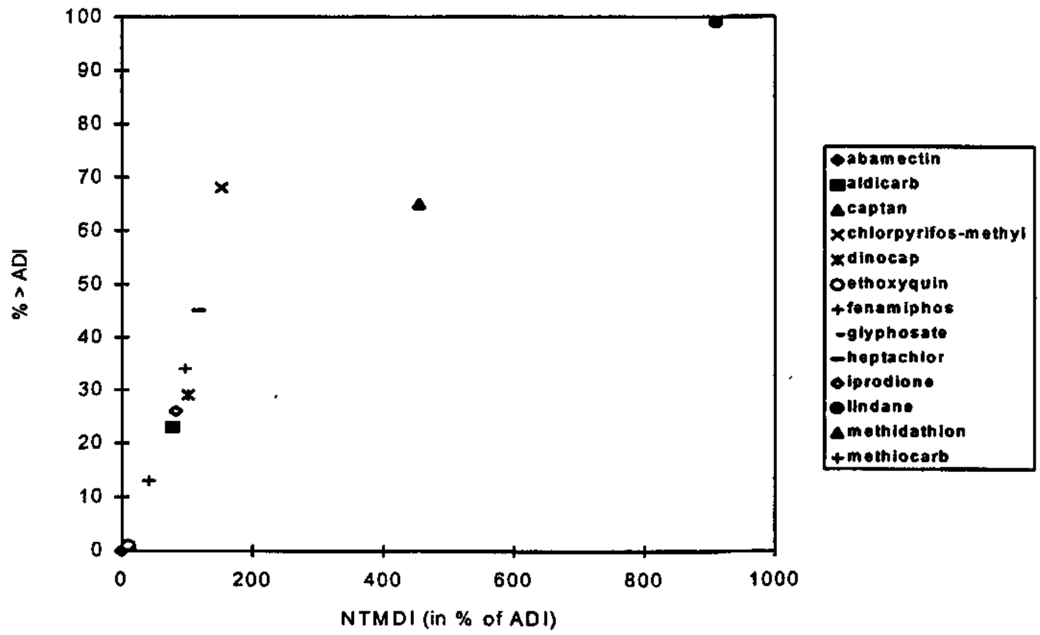


Figure I: *ADI-exceeding against the average National Theoretical Maximum Daily Intake (NTMDI) of the Dutch population (n=6,218)*

IA: 11 pesticides, with average NTMDI<200

IB: 13 pesticides, all

The highest theoretical intakes were found for lindane and methidathion, 910 and 455% of ADI respectively. These two pesticides have the highest number of individuals exceeding the ADI, 99% and 65% respectively. Methidathion and lindane are excluded in figure IA. In figure IB all thirteen selected pesticide residues are included. The NTMDI showed significantly high positive correlation with the number of individuals exceeding the ADI. For pesticides with a NTMDI smaller than 200% of the ADI, this correlation was highest ($r=0.98$, $P<0.0005$) (Figure IA). For all selected 13 pesticides the correlation coefficient was likewise high ($r=0.87$, $P<0.0005$) (Figure IB). Figure I shows the regression equations for both figures. The explained variation, R square, was 96% (Figure IA) and 75% (Figure IB). From the regression equation (IA) it can be predicted that a NTMDI of 100% of the ADI, will result in a exceeding of the ADI for about 37% of the population. For pesticide residues with a NTMDI smaller than 10% of the ADI, it can be observed that almost no persons exceed the ADI (< 1% of the population).
The distributions of theoretical maximum daily intake per kg body weight for the Dutch study population for all thirteen pesticide residues is shown in frequency histograms in appendix III. The variability (spread) among the individuals in the study population is highest for methiocarb and abamectin (CV=178%). Heptachlor, lindane and chlorpyrifos-methyl showed the lowest variability within the population (CV of 48, 56, 57% respectively). All pesticide residues show an intake distribution skewed to the right (appendix III). The ratio 95th percentile intake:mean intake shows that high-intake consumers have a 3-fold higher intake (range 1.9-4.5) than the average consumer of the national food consumption survey.

3.3 Simulated residue content levels

From the thirteen selected pesticides, nine pesticides showed a relevant proportion of individuals exceeding the ADI (>1% of the study population). To study the influence of lowered residue content levels on the distribution of dietary intake calculations with simulated residue content levels were carried out for aldicarb, chlorpyrifos-methyl, dinocap, fenamiphos, heptachlor, iprodione, lindane, methidathion and methiocarb.
The results showed a decrease of the proportion individuals exceeding the ADI, when proportionally lowering the national MRL (table 5). The results of all nine pesticide residues are graphically presented in appendix IV. The relationship between theoretical intake and proportion of persons exceeding the ADI (extreme intake), when proportionally lowering the residue content level, can be described in a sigmoid shaped curve. This non-linear relation starts with a exponential growth curve with a point of inflection followed with a limited growth curve. Figure II shows the results of extended calculations for chlorpyrifos-methyl using 20 simulations of the residue level (10%-200% of MRL).
For lindane and methidathion, with high average theoretical intakes, the lowest MRLs (10-30% of MRL) showed the highest effect on the proportion of ADI-exceeding (appendix IV). For the other

seven pesticide residues, aldicarb, chlorpyrifos-methyl, dinocap, fenamiphos, heptachlor, iprodione and methiocarb, the highest decrease in ADI-exceeding could be observed when the average theoretical daily intake is roughly between 50 and 150% of ADI. For these seven pesticides, with an average NTMDI ranging from 41-153% of the ADI, a simulated lowering of the residue level of 70% (=30% of MRL), demonstrated a proportion of ADI-exceeding ranging from 1-6%. When the residue content level was lowered to 10% of the MRL, the maximum ADI-exceeding was 1% of the population (table 5).

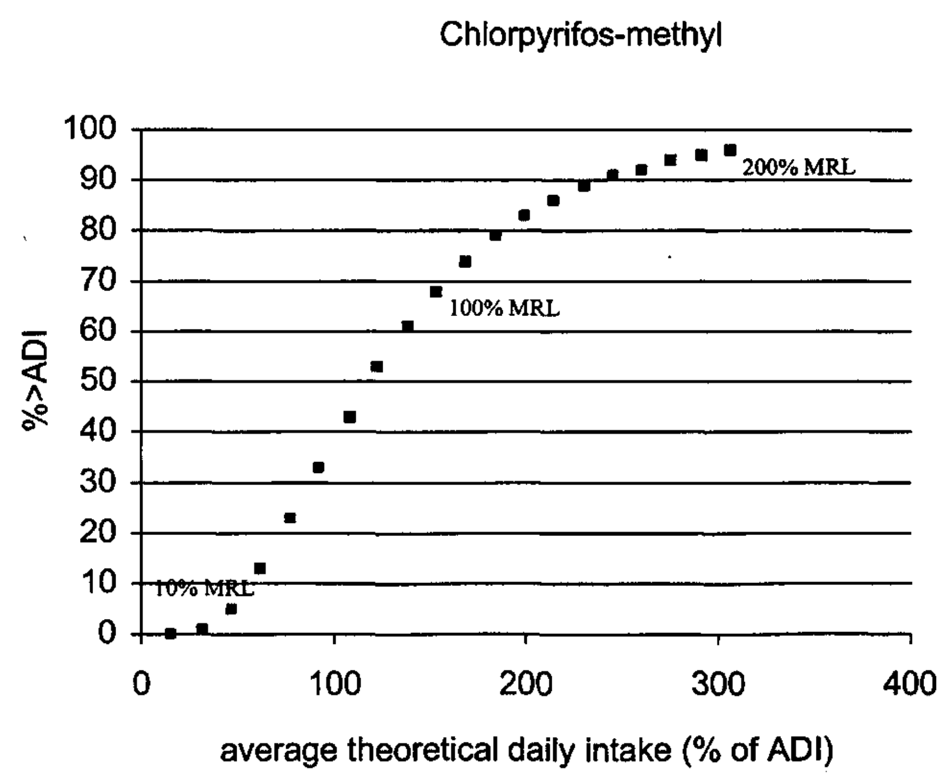


Figure II: *Average theoretical daily intake (in % of ADI) and theoretical proportion of individuals exceeding the ADI (%>ADI), calculated with 20 simulated residue content levels (10%-200% of MRL) for chlorpyrifos-methyl.*

Table 5: Average NTMDI (% of ADI) and proportion of theoretical ADI-exceeding (%>ADI) for different pesticides when proportionally lowering the residue content level (10-70% of MRL).

Pesticide residue	Simulated residue content levels in % of MRL average NTMDI (% of ADI), number of individuals exceeding the ADI (%>ADI)															
	100%MRL		70%MRL		60%MRL		50%MRL		40%MRL		30%MRL		20%MRL		10%MRL	
	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI	%ofADI	%>ADI
aldicarb	77	23	54	11	46	8	39	5	31	3	23	1	15	0	8	0
chlorpyrifos-methyl	153	68	107	43	92	33	77	23	61	13	46	5	31	1	15	0
dinocap	101	29	71	19	61	16	51	13	40	9	30	6	20	3	10	1
fenamiphos	96	34	57	18	49	13	41	9	33	5	25	2	16	1	8	0
heptachlor	117	45	68	24	58	18	49	12	39	7	29	3	19	0	10	0
iprodione	82	26	46	13	40	9	33	6	26	3	20	2	13	1	7	0
lindane	910	99	637	99	546	98	455	97	364	95	273	90	182	75	91	31
methidathion	455	65	265	58	227	55	189	52	151	47	113	41	76	30	38	13
methiocarb	41	13	29	8	25	6	21	4	16	2	12	1	8	0	4	0

3.4 Subgroups of the population

Appendix V shows the statistical values of the calculated NTMDIs for different subgroups of the Dutch population.

The average NTMDI, for the different subgroups of the Dutch population, expressed as a percentage of the corresponding ADI, ranged for abamectin between 0-1%, for aldicarb 57-187%, captan 8-37%, chlorpyrifos-methyl 106-320%, dinocap 44-370%, ethoxyquin 4-39%, for fenamiphos 68-201%, glyphosate 4-9%, heptachlor 53-299%, for iprodione 52-211%, lindane 691-2160%, methidathion 356-1061% and for methiocarb 16-57%. The average NTMDI and the prevalence of theoretical intakes exceeding the ADI was highest among children in the youngest age groups. The average NTMDI of the subgroup of children aged 1-4 years was about 3 times (range 1.4-3.9) as high as the average NTMDI of the overall population. For older children the average NTMDI gradually approaches the adult levels. For people with a vegetarian, vegan, macrobiotic or anthroposophic lifestyle also higher theoretical dietary intakes were found, except for heptachlor and aldicarb, which have established MRLs for animal products. Vegetarians had a theoretical dietary intake about 1.2 times (range 0.8-1.4) as high. In general the average NTMDI for elderly and pregnant women did not show higher average intake levels, except for methidathion (pregnant women) and methiocarb (elderly).

4 DISCUSSION AND CONCLUSIONS

Generally most (inter)national methods for estimating long-term dietary exposure to pesticide residues are limited to fixed-point estimates [WHO, 1997; Pentillä et al, 1996; MAFF, 1997]. These methods take one value for the residue level in/on a crop and combine this with one value for food consumption. This approach is useful when limited data are available for conducting international comparisons and for screening purposes, to identify situations where more refined assessments of intake are required. This method is not useful for evaluating the individual exposure to pesticide residues or for identifying subgroups of the population at risk. In the present study the association between average National Theoretical Maximum Daily Intake (NTMDI) and the distribution of dietary intakes, especially with high levels of intakes, is studied. In this study we carried out the deterministic method, where a single residue figure (MRL or simulated residue level) is combined with the distribution of food consumption data of the Dutch population. The average and individual theoretical daily intake levels of thirteen pesticide residues are assessed and compared with the corresponding ADIs.

Methodological considerations

In this study the distribution of consumption levels from a large scale Dutch food consumption survey were combined with theoretical concentration levels in food commodities. It should be emphasised that the calculated theoretical intakes in this study should be interpreted to a great extent as a 'worst case' event. The calculation of a TMDI, using maximum residue levels (MRLs) represents a crude overestimate of actual dietary intake because, among other things: only a portion of specific crop is treated with a pesticide; most treated crops contain residues well below the MRL at harvest; residues are usually reduced during storage, preparation, commercial processing, and cooking; and, it is unlikely that every food for which an MRL is proposed will have been treated with the pesticide over the lifetime of the consumer [WHO, 1997]. Further dietary exposure assessment in this study uses food consumption data, which are based on 2-day diet records [Anonymous, 1992; Hulshof, 1991]. Since the starting point of an ADI is lifetime exposure, this recording period is relatively short. The average group values obtained with this food record method may be comparable to chronic dietary exposure. However, individual intake figures, which are used in this study for estimation of the proportion of persons exceeding the ADI, are more representative of recent intake and not chronic intake. Therefore high intakes presented in this study are an over-estimation of chronic exposure to a large extent, due to the utilisation of high content levels (MRLs) and the short period of food recording.

Selected pesticide residues

Totally thirteen pesticides have been selected for predicting theoretical dietary intake of the Dutch population; abamectin, aldicarb, captan, chlorpyrifos-methyl, dinocap, ethoxyquin, fenamiphos, glyphosate, heptachlor, iprodione, lindane, methidathion and methiocarb. Most of the selected pesticides are belonging to the group of insecticides (abamectin, aldicarb, fenamiphos, heptachlor, lindane, methidathion, methiocarb) and fungicides (captan, chlorpyrifos-methyl, dinocap, iprodione). Glyphosate was the only herbicide selected and calculations with simulated concentration levels were not carried out because no ADI-exceeding was found. From this study no differences in outcome related to groups of pesticides could be found.

From the thirteen selected pesticides two pesticides had an extreme high NTMDI (lindane, methidathion). Pesticide residues with an average NTMDI (in % of ADI) in the range of 150-500% were not included in this study. Roughly international TMDI figures of GEMS/Foods show that the majority of pesticides are below their ADIs (<100% of the ADI) [CAC, 1998, 1997]. Only a few pesticides exceed this limit and are further evaluated for intake concern. Therefore the selected pesticides in our study can be seen as a good representation of international results. Further, the selected pesticides cover a wide range of agricultural products, which could be present in the human diet.

The selected pesticide residues aldicarb and fenamiphos are highly toxic compounds. The JMPR has developed procedures which led to the establishment of an acute reference dose (RfD). For these pesticides acute dietary risk assessment should be carried out, but detailed acute dietary assessment methods and data bases have not been developed. With the available Dutch consumption data large portion weights for the purpose of acute dietary exposure assessment could be determined. Further a probabilistic approach [NRC, 1993; Petersen, 1994] for dietary intake assessment can be very useful. With the probabilistic methodology a more sophisticated dietary exposure model, that incorporate the probability of selecting foods with different residue levels, could be developed.

Despite possible discrepancies we think that the selected pesticide residues in our study give a good reflection of the average theoretical intakes and the distribution over the Dutch population.

Average NTMDI and exceeding of ADI

This study showed high positive correlation coefficients between average NTMDI and the proportion of persons exceeding the ADI. The coefficients were 0.87 for all 13 selected pesticides and 0.98 for 11 pesticides with a NTMDI < 200. The regression equation of the pesticides, with a NTMDI < 200% of ADI, explained much variation (R^2=0.96) and the standard error (SE=4.9) was relatively low. With this regression equation it can be calculated that an average NTMDI of 100% of the ADI, will result in approximately 35% of the population exceeding the ADI. The selected pesticide residues show that when the average NTMDI is smaller than 10% of the ADI, the number of persons exceeding the ADI will be very small (< 1% of population).

Simulated residue content levels

When proportionally lowering the residue content levels, the relation between average theoretical dietary intake and the proportion of ADI-exceeding can be described in a sigmoid shaped curve. For pesticide residues with an average NTMDI smaller than 100% of the ADI this relation displays an exponential growth curve, as for pesticide residues with a high average NTMDI (>100% of ADI) this relation shows a limited growth curve. Around the point of inflection (about 100-150% of ADI) the simulated lowered MRLs have the highest reducing effect on the proportion of ADI-exceeding.

The IUPAC reported from a set of supervised residue trials that the median residue was commonly 20-40% of the maximum [Hamilton, 1997]. This median (STMR) represent the likely residue to occur if the pesticide residue is used according to the maximum label conditions. For this, the simulated 70% reduction of the residue levels (= 30% of MRL) would be reasonable. In our study a reduction of the maximum residue level of 70%, for pesticide residues with an average NTMDI smaller than 153% of ADI, demonstrate a proportion of ADI-exceeding smaller than 6%. It can be expected that this proportion of theoretical intakes above the ADI will even be smaller, because individual intakes used in this study are more representative of recent intake (mean food intake of 2 days). It might be suggested that an average NTMDI smaller than 150% of the ADI will relieve intake concerns for the total Dutch population. This under the assumption that the STMR is equal of lower than 30% of the MRL and taken into account the short period of food recording.

Since the median residue levels from supervised trails spread broadly from 10 to 70% of the maximum level, depending on the type of commodity, pesticide, application and the country [Hamilton, 1997], it is recommended to use available data from national supervised trials, in stead of simulated residue content levels. More realistic dietary intake assessments are recommended, using all available national data for the estimation of the National Estimated Daily Intake (NEDI) [WHO, 1997]. These data include among others national monitoring data. In the Netherlands the extensive database of the Quality programme of Agricultural Products contains Dutch monitoring data [Klaveren, 1998], could be used for a more realistic dietary exposure assessment.

Recently in the Netherlands, two food frequency questionnaires (FFQs) were compiled in which the first questionnaire specifically investigated chronic loads of animal and vegetable fats (dioxins), and the second investigated residues and health promoting substances that especially appear in fruit and vegetables [Dooren-Flipsen, 1998a; 1998b]. These FFQs can be helpful in estimating usual dietary intake at the individual level and in ranking individuals according to food or chemical intake.

Distribution of intake and subgroups of the population

The theoretical maximum daily intake for extreme consumers (95th percentile intake) is about 3 times higher (range 1.9-4.5) than the average intake of the national food consumption survey.

The variability (spread) among the individuals in the study population is highest for pesticide residues where (high) standards are set for a small number of fruit or vegetables (abamectin, methiocarb). When the number of food commodities is limited, the number of non-consumers, especially for more infrequent consumed products, will increase. This will cause an increase in variability of theoretical dietary intake and result in a limited proportion of ADI-exceeding (consumers only) in the total study population. The percentage of individuals exposed to abamectin, methiocarb and ethoxyquin was limited to 68%, 70% and 82% respectively. Pesticides with a low variability (heptachlor, lindane, chlorpyrifos-methyl) have set standards for (a wide range of) food commodities which are frequently eaten e.g. vegetable/animal fats and cereals.

High consuming individuals exist for both frequent and infrequent consumed products. As stated before, the variability in this study will be overestimated, because the methodology of recording food consumption is a 2-day diary record. High consuming individuals for infrequent consumed products can better be identified with the technique of a food frequency questionnaire.

In carrying out consumer intake estimates at a national level, population subgroups, could be considered where appropriate food consumption data are available [WHO, 1997]. In the UK calculations are carried out for infants, schoolchildren and adults on a routine basis. In the future calculations in the UK will be extended with toddlers and vegetarians. Germany uses an 'extreme' consumer (4 year old girls). In the Netherlands the average Dutch diet of primary agricultural products is derived from the Dutch National Food Consumption Survey 1992. These dietary intake data resemble the average food intake from a representative sample of the Dutch population, but not for subgroups of the Dutch population [Dooren-Flipsen et al, 1996a].

The present study shows that average NTMDIs and the prevalence of ADI-exceeding can vary greatly over different subgroups of the Dutch population. The highest intakes can be observed among children in the youngest age groups and people with a vegetarian lifestyle. The average NTMDI of the subgroup of young children aged 1-4 years was about 3 times as high as the average NTMDI of the overall population. Vegetarians have a theoretical dietary intake about 1.2 times as high. . It is recommended to develop a separate national diet for the risk group of children for the risk evaluation of pesticide residues.

The ADI is intended to cover all vulnerable groups (including different age groups) within the human population. Therefore it is recommended to further characterise the high intake group of the Dutch population for different pesticide residues. In addition the risk group of infants (<1 year), which are not included in the Dutch National Food Consumption Surveys should be taken into consideration.

LITERATURE

Anonymous
Descriptive Report on the automated calculation of data from the 2nd Dutch National Nutrition Survey 1992
[Beschrijvend rapport inzake de opzet en uitvoering van de Voedselconsumptiepeiling (VCP) 1992]
Dongen: AOB Fresh Foods, 1994

CAC, Codex Alimentarius Commission
Codex Committee on Pesticide Residues, thirtieth session,
The Hague, The Netherlands, 20-25 April 1998
Progress report by WHO on prediction of theoretical dietary intake of pesticide residues
Consideration of intake of pesticide residues: Report on pesticide residue intake studies at international and national level based on revised guidelines for predicting dietary intake of pesticide residues

CAC, Codex Alimentarius Commission
Codex Committee on Pesticide Residues, twenty-ninth session,
The Hague, The Netherlands, 7-12 April 1997
Progress report by WHO on prediction of theoretical dietary intake of pesticide residues
Consideration of intake of pesticide residues: Report on pesticide residue intake studies at international and national level

Dooren-Flipsen, M.M.H. van, Klaveren, J.D. van
ANI-Voedselfrequentievragenlijst: Ontwikkeling vragenlijst naar de inname van vetoplosbare residuen en contaminanten
RIKILT-DLO report 98.04, 1998a

Dooren-Flipsen, M.M.H. van, Klaveren, J.D. van
VEG-Voedselfrequentievragenlijst: Ontwikkeling vragenlijst naar de inname van stoffen gerelateerd aan plantaardige voedingsmiddelen
RIKILT-DLO report 98.05, 1998b

Dooren-Flipsen, M.M.H. van, Klaveren, J.D. van, Donkersgoed, G. van
Theoretical maximum daily intake of pesticide residues in the Netherlands - a model for risk assessment
RIKILT-DLO report 96.28, 1996a

Dooren, M.M.H. van, Boeijen, I. van, Klaveren, J.D. van, Donkersgoed, G. van
Conversie van consumeerbare voedingsmiddelen naar primaire agrarische producten. Berekening inname residuen en contaminanten
Voeding, 57, 5, 6-9, 1996b

Dooren, M.M.H. van, Boeijen, I. van, Klaveren, J.D. van, Donkersgoed, G. van
Conversie van consumeerbare voedingsmiddelen naar primaire agrarische producten
RIKILT-DLO report 95.17, 1995

Eck, W.H. van, Dornseiffen, J.W.
Residuen van landbouwbestrijdingsmiddelen
Gewasbescherming 26, 3, 79-85, 1995

Hamilton, D.J., Holland, P.T., Ohlin, B., Murray, W.J., Ambrus, A., De Baptista, G.C., Kovacicová, J.
Optimum use of available residue data in the estimation of dietary intake of pesticides
Pure & Applied Chemistry, 69, 1373-1410, 1997

Hulshof, K.F.A.M., Staveren, W.A. van
The Dutch national food consumption survey. Design, methods and first results
Food Policy, 13, 359-365, 1991
WHO, 1997, Guidelines for Predicting Dietary Intake of Pesticide Residues (revised). Global Environment Monitoring Sytem - Food Contamination Monitoring and Assessment Programme (GEMS/Food) in collaboration with the Codex Committee on Pesticide Residues, WHO, Geneva

Klaveren, J.D. van
Programme for the quality of Agricultural Products
Results residue monitoring in The Netherlands
RIKILT-DLO, 1998

MAFF
Ministry of Agriculture, Fisheries and Food
Pesticide Safety Directorate
Consumer Exposure Model

http://www.maff.gov.uk/aboutmaf/agency/psd/software/install.htm 1997

NRC, National Research Council, US
Pesticides in the Diets of Infants and Children
Natl. Acad. Sci. Press, Washington, DC., 1993

Pentillä, P.L., Siivinen, K.
Control and intake of pesticide residues during 1981-1993 in Finland
Food Additives and Contaminants, 13, 6, 609-622, 1996

Petersen, B.J., Barraj, L.M., Muenz, L.R., Harrison, S.L.
An alternative approach to dietary exposure assessment
Risk Analysis, 14, 6, 913-916, 1994

WHO, 1989, Guidelines for Predicting Dietary Intake of Pesticide Residues. Global Environment Monitoring Sytem - Food Contamination Monitoring and Assessment Programme (GEMS/Food) in collaboration with the Codex Committee on Pesticide Residues, WHO, Geneva

APPENDIX I: Terminology risk analysis.

Risk analysis

A process consisting of three components: risk assessment, risk management and risk communication.

Risk assessment A scientifically based process consisting of the following steps:

(i) *hazard identification* = the identification of biological, chemical and physical agents capable of causing adverse health effects and which may be present in a particular food or groups of food

(ii) *hazard characterization* = the qualitive and/or quantitive evaluation of the nature of the adverse health effects associated with biological, chemical and physical agents which may be present in food. For chemical agents, a dose-response assessment should be performed. For biological and physical agents, a dose-reponse assessment should be performed if the data is obtainable.

(iii) *exposure assessment* = the qualitative and/or quantitative evaluation of the likely intake of biological, chemical or physical agents via food as well as exposure from other sources if relevant.

(iv) *risk characterization* = the qualitative and/or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of known or potential adverse health effects in a given population based on hazard identification, hazard characterization and exposure assessment.

Risk management The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control options, including regulatory measures.

Risk communication The interactive exchange of information and opinions concerning risk among risk assessors, risk managers, consumers and other interested parties.

APPENDIX II: MRLs of the selected pesticide residues as stated in the Dutch Pesticide Law in the regulation of pesticide residues (Stcrt 91, 12 May, 1997)

ABAMECTIN

Product	Maximum residue limit (MRL) (mg/kg)
aubergines	0,02
peppers	0,02
tomatoes	0,02
other	0*(0,01)

ALDICARB

Product	Maximum residue limit (MRL) (mg/kg)
citrus fruit	0,2
pecan nuts	0,2
bananas	0,5
cauliflower	0,2
Brussels sprouts	0,2
cotton seed	0,1
potatoes	0,5
meat	0,01*
milk	0,01*
eggs	0,01*
other	0,05*

CAPTAN

Product	Maximum residue limit (MRL) (mg/kg)
pome fruits	3
stone fruit	2
berries	3
small fruit	3
other fruit	0,1*
tomatoes	3
leafy vegetables I	2
witloof	2
leeks	2
legume vegetables	2
other vegetables	0,1*
grains	0,1*
raisin	5
other	0*(0,1)

CHLORPYRIFOS-METHYL

Product	Maximum residue limit (MRL) (mg/kg)
pome fruits	0,5
peaches (including nectarines and similar hybrids)	0,5
table and wine grapes	0,2
strawberries (other than wild)	0,5
Solanaceae	0,5
Globe artichokes	0,1
tea	0,1*
hops	0,1*
rice	0,05*
other grains	5
milk	0,01*
eggs	0,01*
other	0,05*

DINOCAP

Product	Maximum residue limit (MRL) (mg/kg)
apples	0,5
fruiting vegetables	0,1
other	0*(0,05)

ETHOXYQUIN

Product	Maximum residue limit (MRL) (mg/kg)
apples	3
pears	3
other	0,05*

FENAMIPHOS

Product	Maximum residue limit (MRL) (mg/kg)
oranges	0,2
table and wine grapes	0,1
bananas	0,1
sweet potatoes	0,1
potatoes	0,1
coffee beans	0,1
coffee	0,1
other	0,05*

GLYPHOSATE

Product	Maximum residue limit (MRL) (mg/kg)
mushrooms (wild)	50
linseed	10
rape seed	10
soya beans	20
wheat, rye and triticale	5
barley and oats	20
kidneys of pig	0,5
kidney of cow, goat and sheep	2
other	0,1*

HEPTACHLOR

Product	Maximum residue limit (MRL) (mg/kg)	
vegetable oils and fats	0,02	
tea	0,02*	
meat	0,2	2)
milk	0,004	3)
eggs	0,02	4)
wild and poultry	0,2	2)
eel	0,05	
liver of fish	0,1	
other fishery products	0,02	
other	0,01*	

IPRODIONE

Product	Maximum residue limit (MRL) (mg/kg)
pome fruits	10
stone fruit	5
table and wine grapes	10
strawberries (other than wild)	10
cane fruit (other than wild)	5
bilberries	10
currants (red, black and white)	10
gooseberries	10
kiwi fruit	5
carrots	10
radishes	5
bulb vegetables	5
Solanaceae	5
Cucurbitaceae (with edible peel)	2
melons	5
flowering brassicas	5
Brussels sprouts	5
head brassicas	5
leafy brassicas	5
kohlrabi	0,1
lettuce and similar	10
witloof	1
herbs	10
legume vegetables (fresh)	5
horseradish	5
rhubarb	0,2
pulses	0,2
rape seed	0,5
caraway	2
tea	0,1*
hops	0,1*
wheat	0,5
rice	3
meat	0,05*
milk	0,05*
eggs	0,05*
other	0,02*

LINDANE

Product	Maximum residue limit (MRL) (mg/kg)	
stone fruit	0,5	
table and wine grapes	0,5	
other fruit	1	
carrots	0,1	
tomatoes	2	
leafy brassicas	2	
lettuce and similar	2	
cress	2	
witloof	2	
other vegetables	1	
pulses	1	
tea	0,2	
grains	0,1	
whole meal	0,05	
cacoa beans	1	
cacoa products	1	1)
coffee (roasted)	1	
meat sheep	2	2)
other meat	1	2)
milk	0,008	3)
eggs	0,1	4)
wild and poultry	1	2)
eel	0,2	
liver of fish	0,5	
other fishery products	0,1	
other	0,01*	

METHIDATHION

Product	Maximum residue limit (MRL) (mg/kg)
citrus fruit	2
nuts	0,05*
pome fruits	0,3
stone fruit	0,2
table and wine grapes	0,5
olives	1
rape seed	0,05
cotton seed	0,2
tea	0,1*
hops	3
other	0,02*

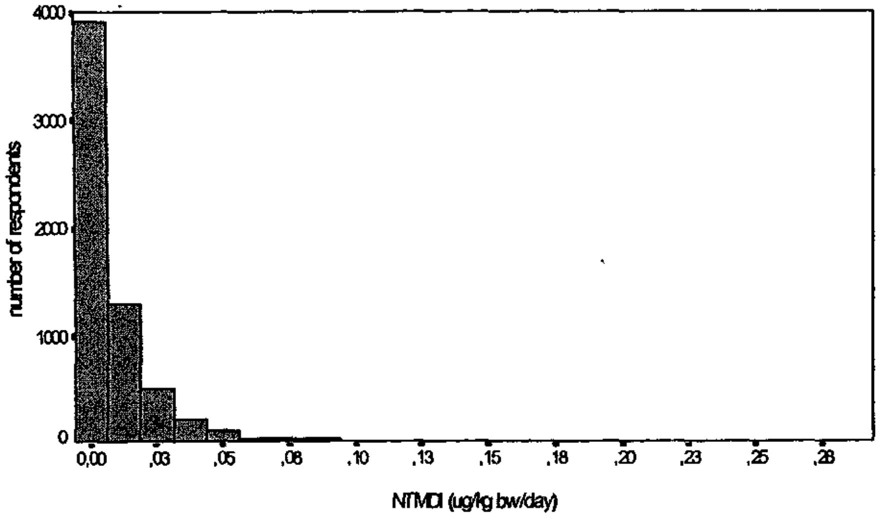
METHIOCARB

Product	Maximum residue limit (MRL) (mg/kg)
cucumbers	0,5
melons	0,5
flowering brassicas	0,1
head brassicas	0,1
lettuce and similar	1
other	0,05*

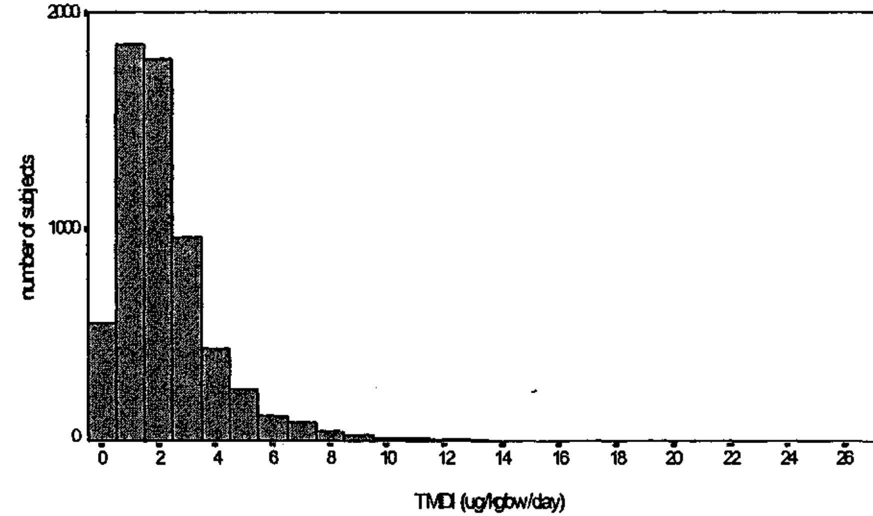
*	=	Pesticide may be used, without leaving residues in the product above the limit of determination.
0*	=	Pesticide may not be used. Value between parentheses is the limit of determination.
1)	=	In mg/kg of fat.
2)	=	In the case of foodstuffs with a fat content of 10% or less by weight, the residue is related to the total weight of the boned foodstuff. In such cases, the maximum level is one-tenth of the value related to fat content, but must be no less than 0.01 mg/kg.
3)	=	In determining the residues in raw cow's milk and whole cream cow's milk, a fat content of 4% by weight should be taken as a basis. For raw milk and whole cream milk of another animal origin the residues are expressed on the basis of the fat: - with a fat content of less than 2% by weight, the maximum level is taken as half that set for raw milk and whole cream milk - with a fat content of 2% or more by weight, the maximum level is expressed in mg/kg of fat. In such cases, the maximum level is 25 times that set for raw milk and whole cream milk
4)	=	For eggs and egg products with a fat content higher than 10% the maximum level is expressed in mg/kg fat. In this case the maximum level is 10 times higher than the maximum level for fresh eggs.

APPENDIX III: Distribution of National Theoretical Maximum Daily Intake (NTMDI) for the Dutch population (n=6,218).

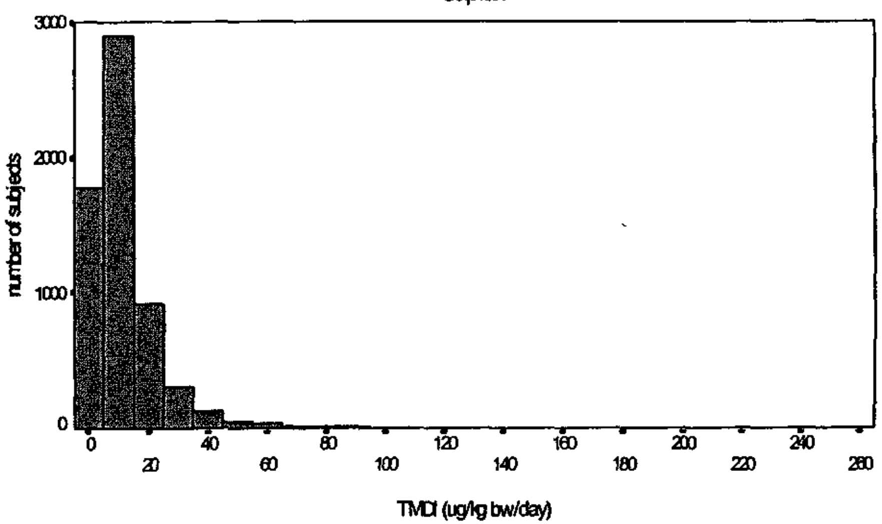
Abamectin



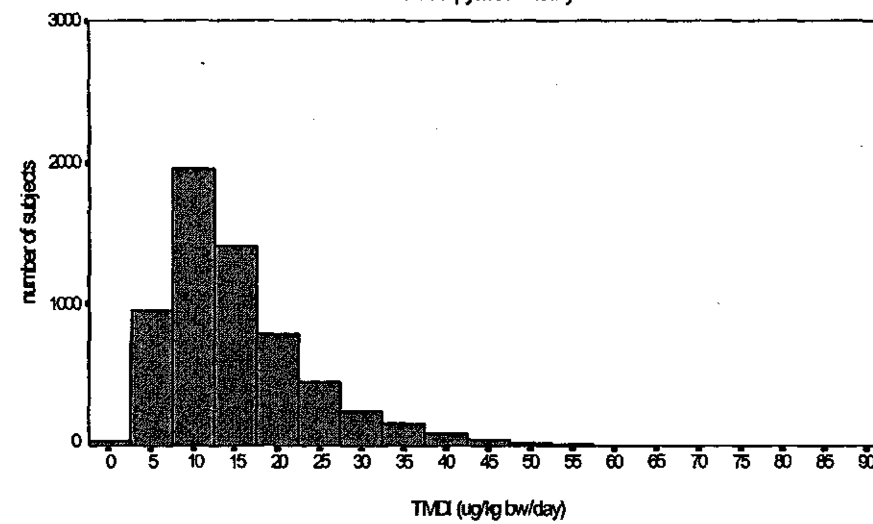
Aldicarb



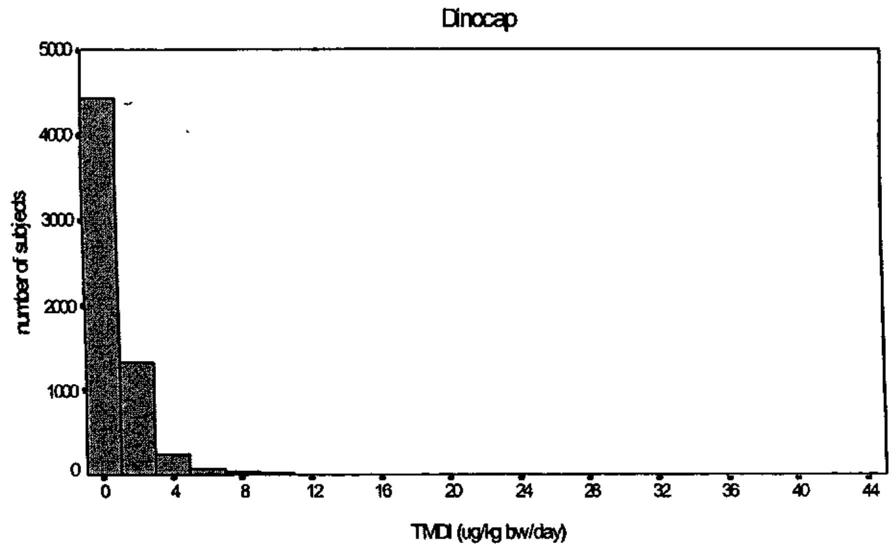
Captan

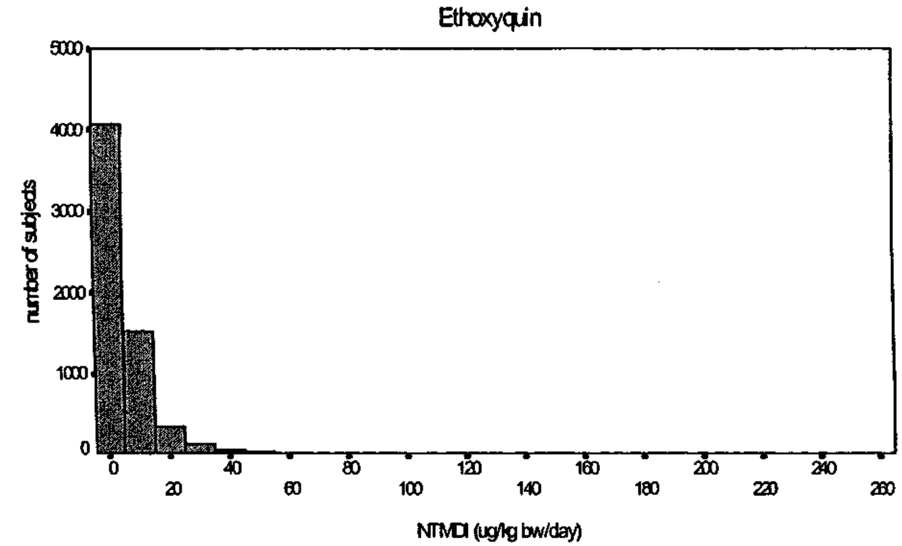


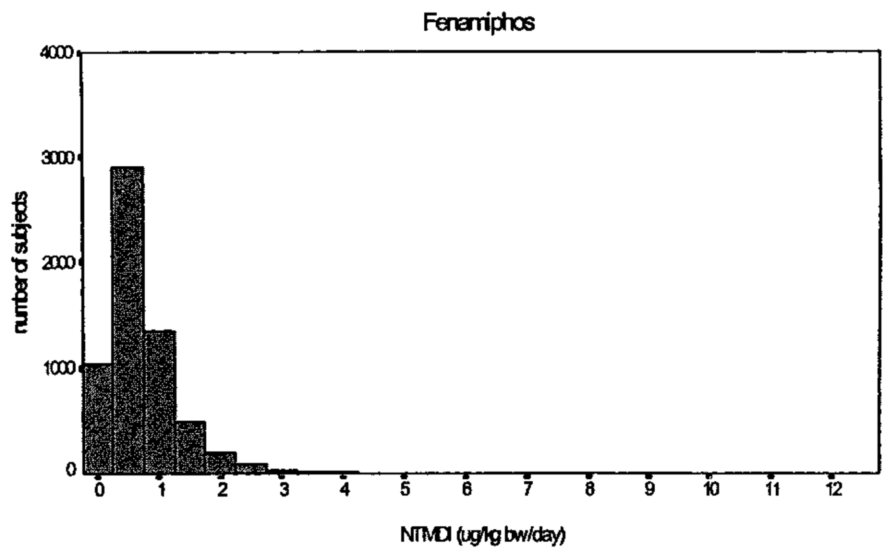
Chloorpyrifos-methyl

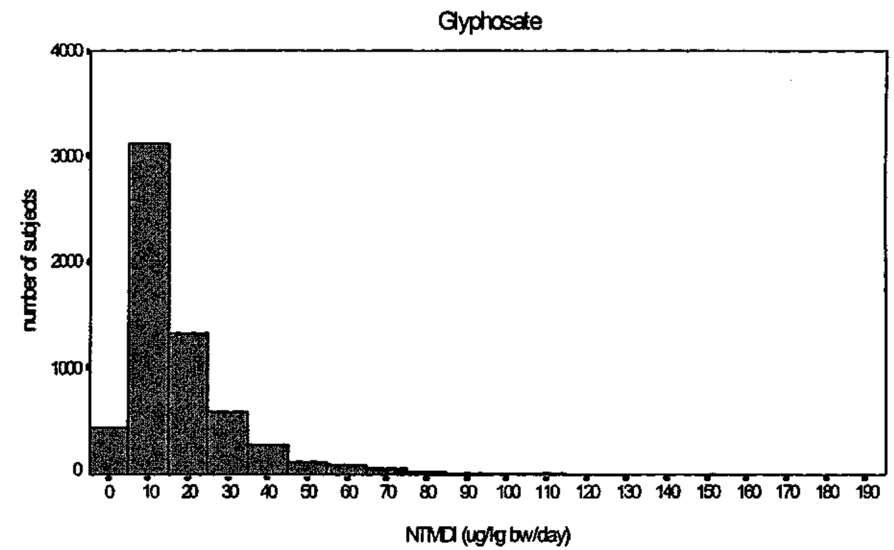


APPENDIX III: *Continued.*

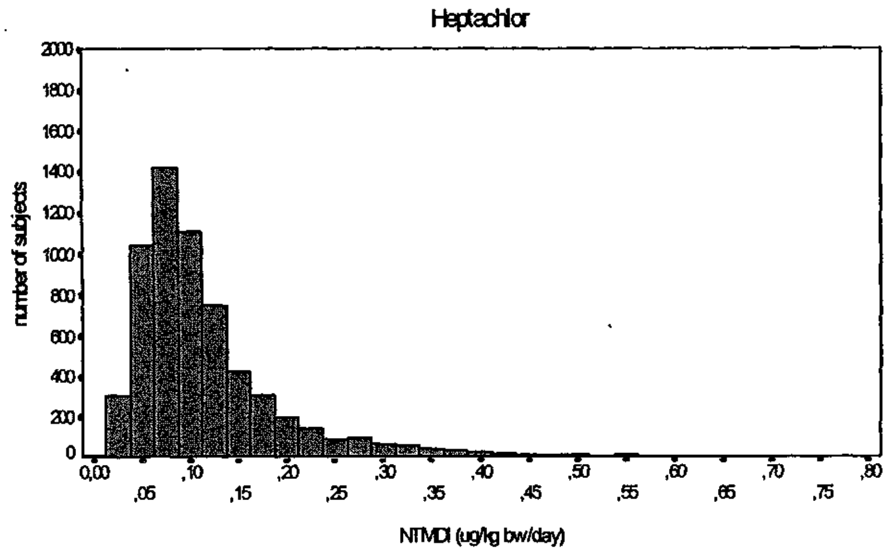


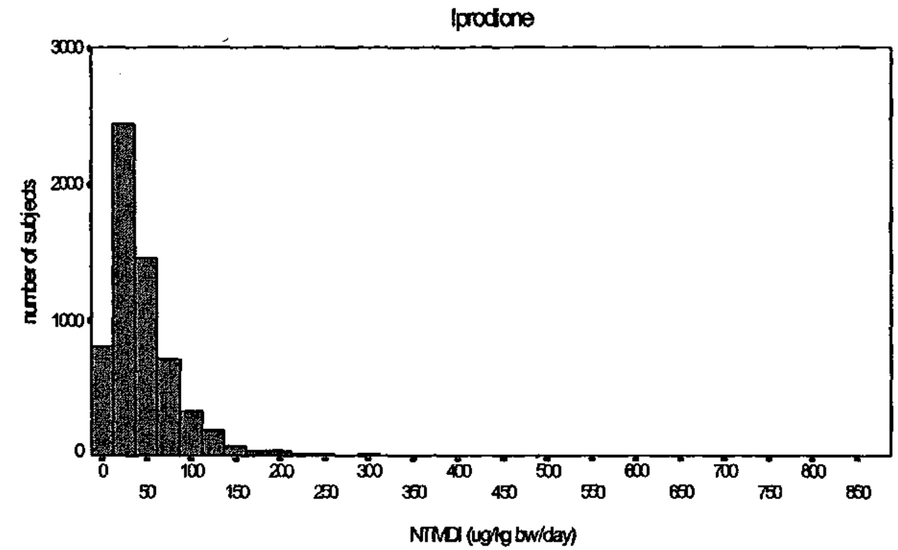


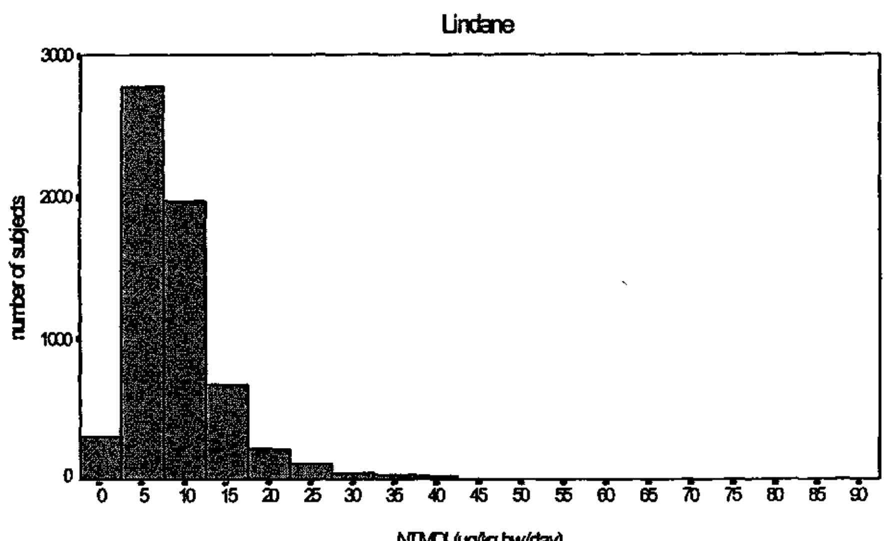


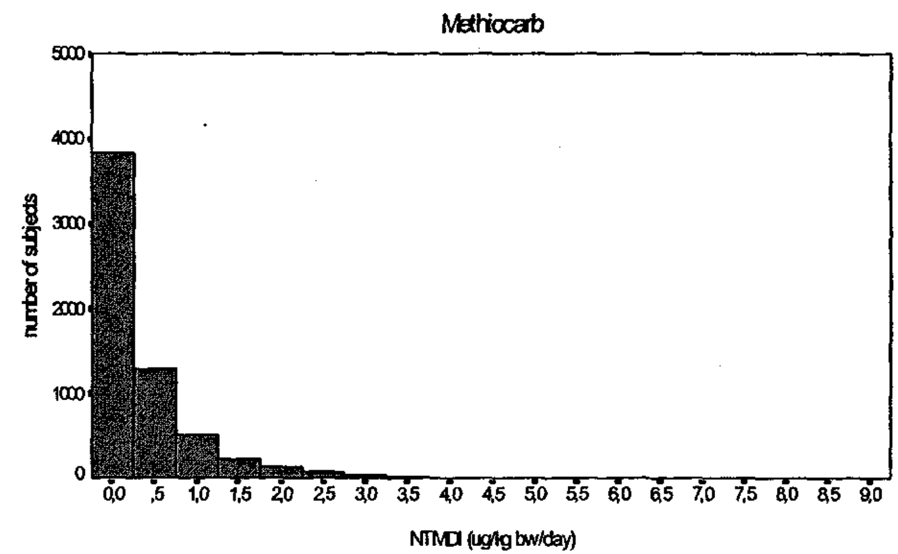


APPENDIX III: Continued.

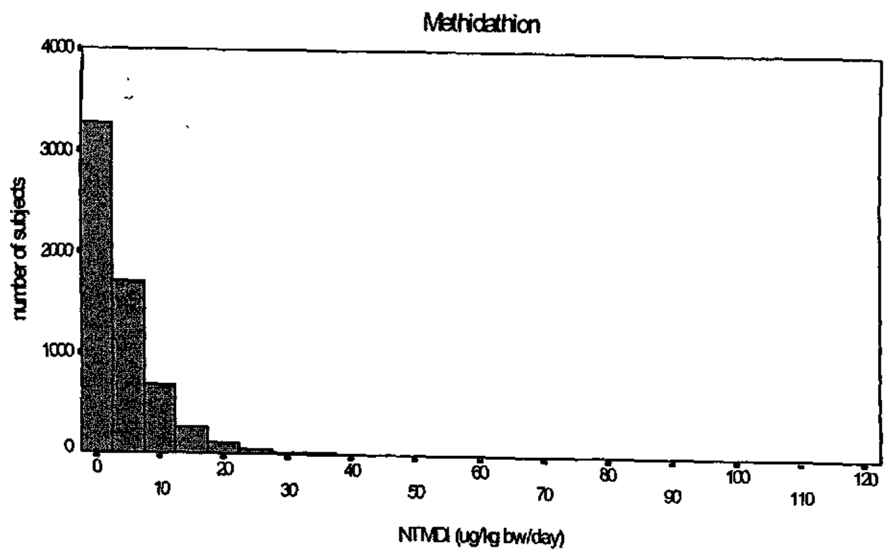






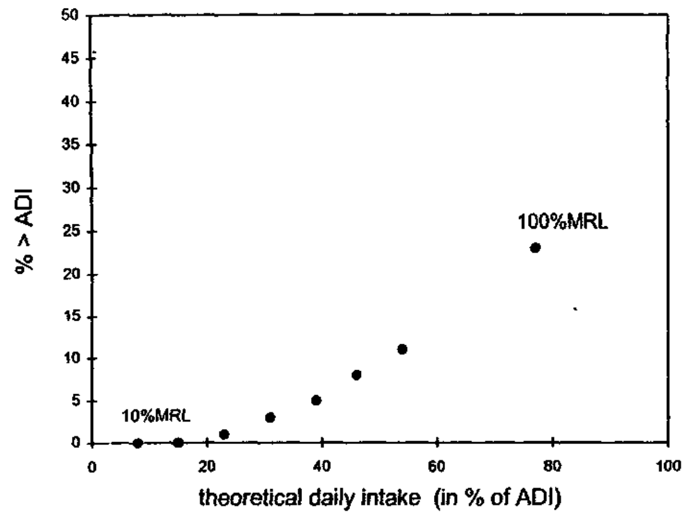


APPENDIX III: *Continued.*

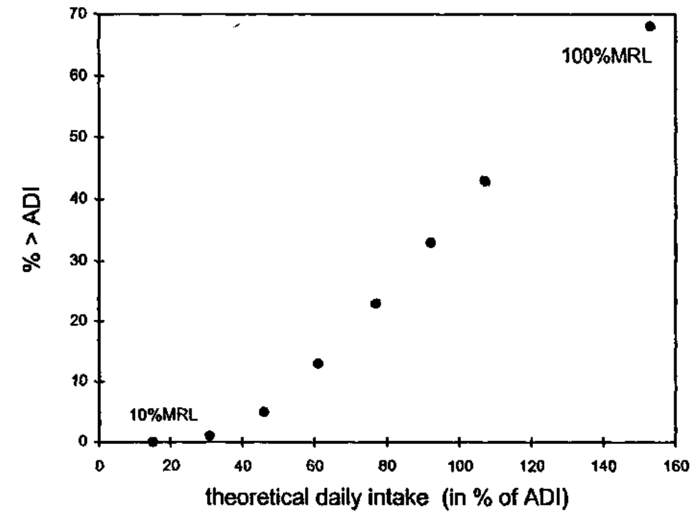


APPENDIX IV: Average theoretical daily intake (in % of ADI) and proportion of theoretical ADI-exceeding (% > ADI), calculated with proportionally lowered MRLs (10%-70% MRL) for different pesticides.

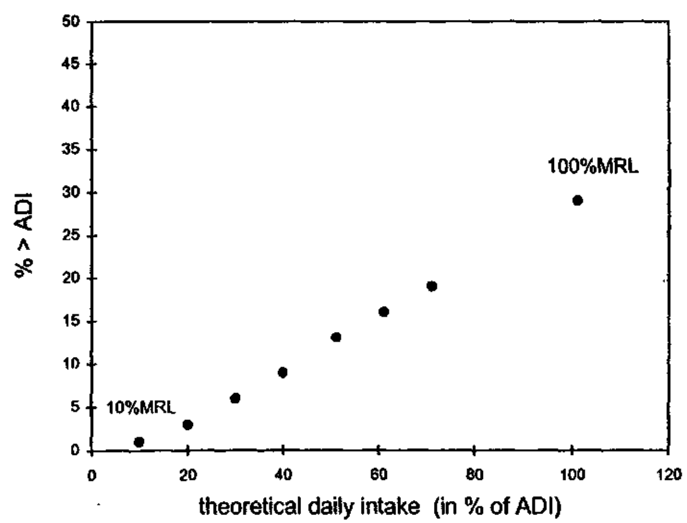
Aldicarb



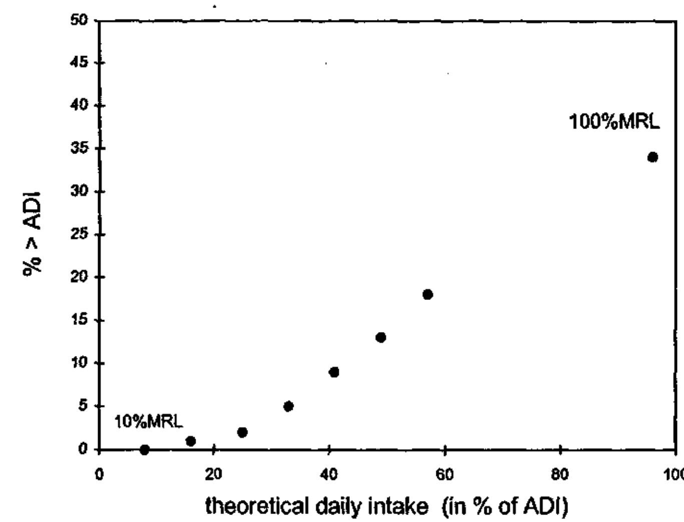
Chlorpyrifos-methyl



Dinocap

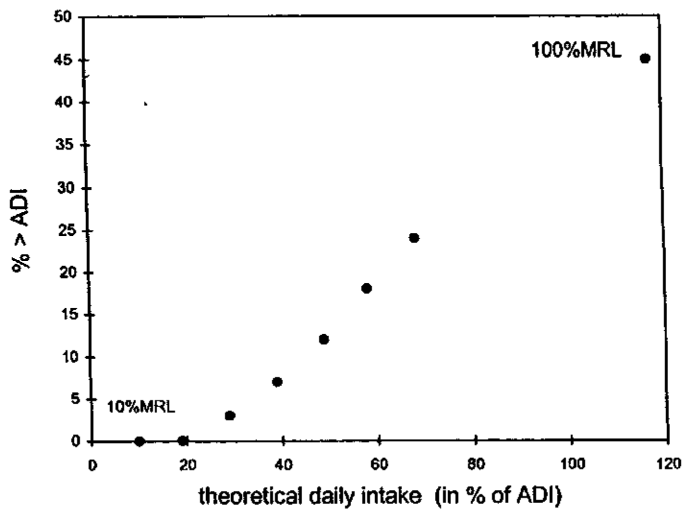


Fenamiphos

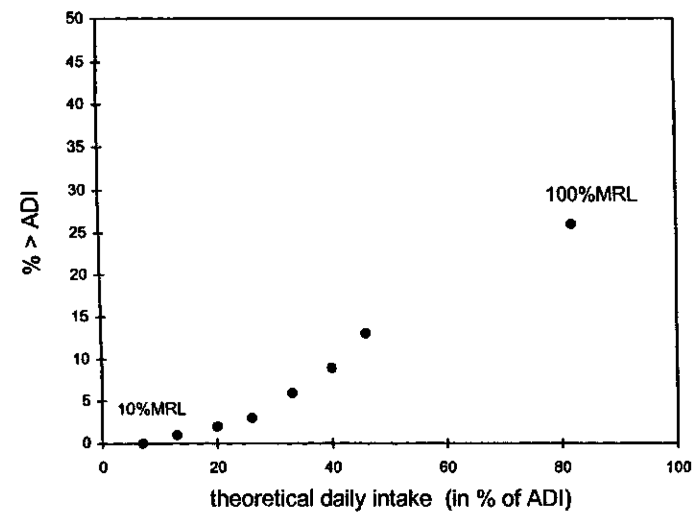


APPENDIX IV: *Continued.*

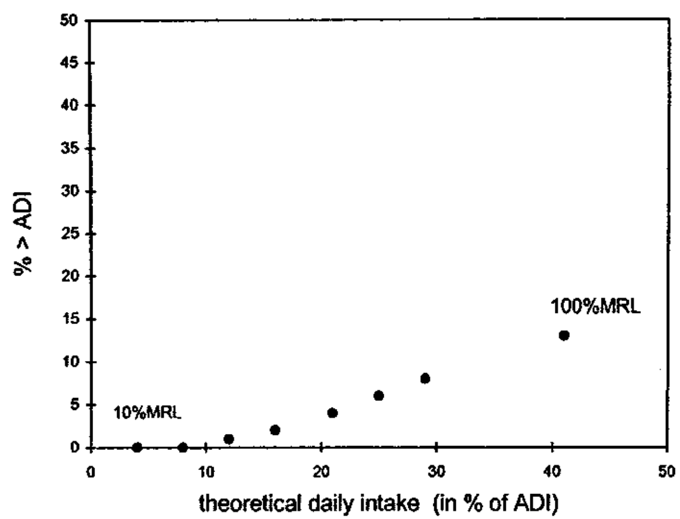
Heptachlor



Iprodione

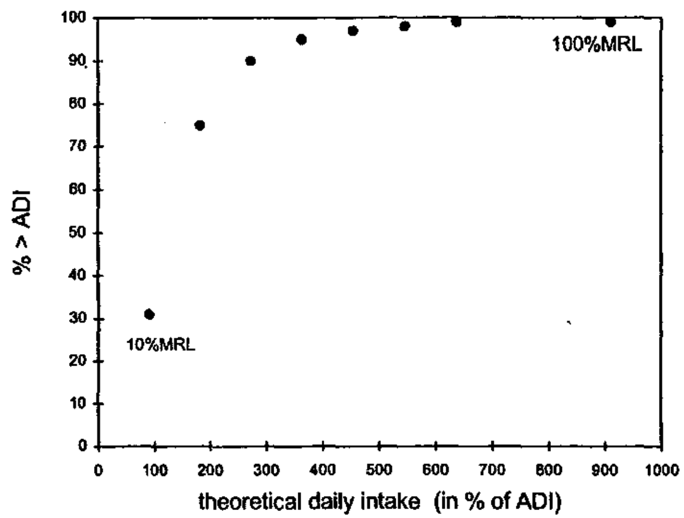


Methiocarb

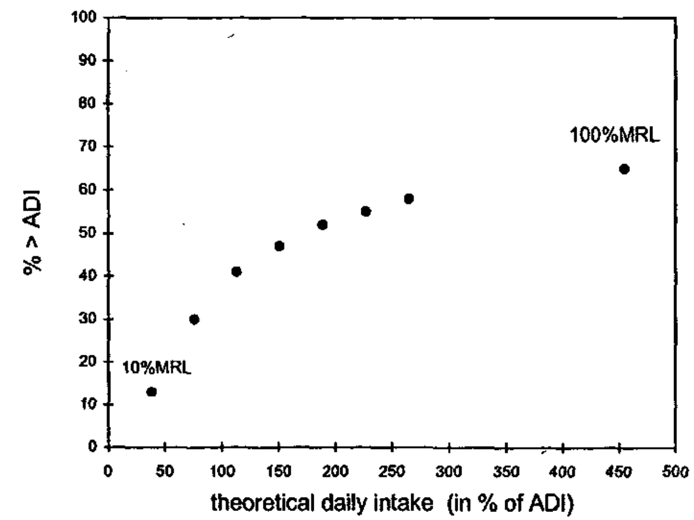


APPENDIX IV: Continued.

Lindane



Methidathion



APPENDIX V: Statistical values National Theoretical Maximum Daily Intake (NTMDI) for different sub-groups of the Dutch population

Dutch National Food Consumption Survey 1992 (DNFCS-92)
ABAMECTINE - MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0020 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	.55	.98	.18	2.36	.01	.02	.00	.04			.0
MEN	2881	.56	1.04	.19	2.33	.01	.02	.00	.04			.0
WOMEN	3337	.54	.93	.17	2.38	.01	.02	.00	.04			.0
1-4 YEAR	351	.19	.33	.05	.91	.01	.03	.00	.07	1		.0
4-7 YEAR	329	.23	.50	.03	.98	.01	.02	.00	.05	1		.0
7-10 YEAR	254	.36	.63	.09	1.71	.01	.02	.00	.06	1		.0
10-13 YEAR	255	.39	.65	.11	2.09	.01	.02	.00	.05	1		.0
13-16 YEAR	252	.45	.79	.14	1.97	.01	.01	.00	.04			.0
16-19 YEAR	253	.46	.71	.19	1.91	.01	.01	.00	.03			.0
19-22 YEAR	218	.62	1.00	.27	2.61	.01	.01	.00	.04			.0
22-50 YEAR	2857	.70	1.17	.25	2.79	.01	.02	.00	.04			.0
50-65 YEAR	950	.56	.97	.19	2.27	.01	.01	.00	.03			.0
65+ YEAR	499	.40	.69	.10	1.73	.01	.01	.00	.03			.0
PREGNANT WOMEN	58	.66	.82	.30	2.40	.01	.01	.00	.03			.0
VEGETARIANS	65	1.02	1.11	.67	3.23	.02	.02	.01	.06	1		.0
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	.96	1.13	.60	3.63	.02	.02	.01	.06	1		.0
IMMIGRANTS (NOT EUROPEAN)	24	.84	1.02	.57	2.64	.01	.01	.01	.04	1		.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
ALDICARB - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0030 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	121.7	79.8	108.5	267.6	2.3	2.0	1.8	6.0	77	1451	23.3
MEN	2881	130.2	86.1	114.9	289.1	2.3	2.0	1.9	6.0	77	681	23.6
WOMEN	3337	114.4	73.2	103.8	248.0	2.3	2.1	1.8	5.9	77	770	23.1
1-4 YEAR	351	74.6	51.5	65.2	166.2	5.6	4.0	4.9	12.6	187	251	71.5
4-7 YEAR	329	89.3	61.9	76.8	206.9	4.4	3.1	3.8	10.2	145	210	63.8
7-10 YEAR	254	105.8	64.2	98.1	244.1	3.7	2.3	3.5	7.7	125	148	58.3
10-13 YEAR	255	126.9	69.6	116.2	261.4	3.2	1.8	3.0	7.0	108	127	49.8
13-16 YEAR	252	140.3	81.2	126.3	288.7	2.7	1.6	2.3	5.7	89	83	32.9
16-19 YEAR	253	137.6	96.0	121.0	314.7	2.2	1.5	1.9	4.6	72	57	22.5
19-22 YEAR	218	144.0	97.1	127.0	313.4	2.1	1.4	1.8	4.5	69	49	22.5
22-50 YEAR	2857	125.5	82.3	113.7	276.5	1.8	1.2	1.6	4.0	58	375	13.1
50-65 YEAR	950	126.1	79.3	114.4	264.4	1.7	1.1	1.6	3.7	57	110	11.6
65+ YEAR	499	124.7	68.0	114.4	257.1	1.7	1.0	1.6	3.4	57	41	8.2
PREGNANT WOMEN	58	126.2	62.3	119.1	243.6	1.8	1.0	1.6	3.3	61	6	10.3
VEGETARIANS	65	116.2	78.6	92.5	264.5	1.9	1.4	1.5	4.7	64	12	18.5
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	109.6	75.3	92.0	264.5	1.9	1.5	1.5	4.9	63	13	16.9
IMMIGRANTS (NOT EUROPEAN)	24	82.4	54.9	77.3	161.8	1.1	.6	1.1	1.9	37		.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
CAPTAN - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .1000 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	618	510	508	1497	12	15	9	35	12	30	.5
MEN	2881	612	527	505	1504	12	16	8	35	12	13	.5
WOMEN	3337	624	494	510	1491	13	15	9	34	13	17	.5
1-4 YEAR	351	494	438	388	1283	37	34	28	94	37	17	4.8
4-7 YEAR	329	573	517	428	1552	28	28	21	68	28	9	2.7
7-10 YEAR	254	569	533	444	1276	20	21	15	46	20	2	.8
10-13 YEAR	255	589	413	510	1354	15	11	14	35	15		.0
13-16 YEAR	252	556	418	462	1336	10	8	9	24	10		.0
16-19 YEAR	253	566	481	477	1407	9	8	8	22	9		.0
19-22 YEAR	218	574	421	474	1445	8	6	7	19	8		.0
22-50 YEAR	2857	593	530	477	1458	8	8	7	21	8	2	.1
50-65 YEAR	950	729	523	615	1765	10	7	8	25	10		.0
65+ YEAR	499	792	460	710	1645	11	7	10	23	11		.0
PREGNANT WOMEN	58	750	614	560	2099	11	9	8	27	11		.0
VEGETARIANS	65	1034	1359	836	2007	17	22	12	33	17	1	1.5
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	990	1271	752	2029	17	21	12	38	17	1	1.3
IMMIGRANTS (NOT EUROPEAN)	24	591	348	535	1149	8	5	8	14	8		.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
CHLORPYRIFOS METHYL - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0100 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	851	487	737	1766	15	9	13	34	153	4247	68.3
MEN	2881	1035	573	904	2155	17	10	15	36	172	2194	76.2
WOMEN	3337	692	323	651	1231	14	9	12	31	137	2053	61.5
1-4 YEAR	351	430	162	408	751	32	13	32	55	320	342	97.4
4-7 YEAR	329	569	193	543	896	28	10	27	45	277	325	98.8
7-10 YEAR	254	641	211	620	1012	23	8	22	35	229	249	98.0
10-13 YEAR	255	706	239	669	1141	18	7	17	31	180	232	91.0
13-16 YEAR	252	763	275	724	1275	14	5	14	24	144	195	77.4
16-19 YEAR	253	887	405	800	1657	14	6	12	26	139	180	71.1
19-22 YEAR	218	931	515	838	1912	14	7	12	28	135	145	66.5
22-50 YEAR	2857	976	552	848	2062	13	7	12	27	134	1836	64.3
50-65 YEAR	950	857	490	752	1639	12	6	10	22	116	506	53.3
65+ YEAR	499	776	339	706	1351	11	5	10	19	106	237	47.5
PREGNANT WOMEN	58	784	324	776	1469	11	5	11	20	111	33	56.9
VEGETARIANS	65	1040	772	803	2268	16	12	13	30	164	46	70.8
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	1020	723	800	2268	17	12	14	36	169	56	72.7
IMMIGRANTS (NOT EUROPEAN)	24	867	511	747	1819	12	7	11	23	119	13	54.2

Dutch National Food Consumption Survey 1992 (DNFCS-92)
DINOCAP - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0010 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	45.4	64.4	24.3	151.4	1.0	2.1	.4	3.8	101	1788	28.8
MEN	2881	43.2	66.3	22.1	147.0	1.0	2.1	.3	3.8	96	732	25.4
WOMEN	3337	47.2	62.7	26.8	154.3	1.1	2.1	.5	3.8	106	1056	31.6
1-4 YEAR	351	50.0	66.1	27.7	175.3	3.7	5.0	2.1	12.3	370	233	66.4
4-7 YEAR	329	60.9	79.9	38.8	198.2	3.0	4.3	1.9	9.0	301	201	61.1
7-10 YEAR	254	58.2	84.0	37.9	176.8	2.1	3.3	1.2	6.1	210	138	54.3
10-13 YEAR	255	52.0	58.1	38.9	155.5	1.4	1.6	1.0	4.1	135	126	49.4
13-16 YEAR	252	45.7	57.1	24.7	165.1	.9	1.1	.5	3.1	88	81	32.1
16-19 YEAR	253	41.7	63.5	17.9	164.7	.7	1.1	.3	2.6	68	55	21.7
19-22 YEAR	218	41.5	53.3	21.6	156.6	.6	.7	.3	2.2	60	48	22.0
22-50 YEAR	2857	39.0	64.1	18.2	133.7	.6	.9	.3	1.9	55	519	18.2
50-65 YEAR	950	50.1	61.9	33.2	161.8	.7	.8	.4	2.3	68	240	25.3
65+ YEAR	499	52.8	53.0	42.4	148.7	.7	.7	.6	2.2	73	147	29.5
PREGNANT WOMEN	58	61.4	86.1	27.1	268.9	.9	1.2	.4	3.6	86	16	27.6
VEGETARIANS	65	79.0	185.6	40.1	201.9	1.3	3.0	.7	3.1	128	23	35.4
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	79.1	171.8	46.2	201.9	1.4	2.9	.7	5.4	142	30	39.0
IMMIGRANTS (NOT EUROPEAN)	24	33.7	41.4	22.0	104.9	.4	.5	.3	1.4	44	3	12.5

Dutch National Food Consumption Survey 1992 (DNFCS-92)
ETHOXYQUIN - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0600 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	276	408	143	959	6	13	3	24	10	63	1.0
MEN	2881	262	420	118	934	6	13	2	24	10	31	1.1
WOMEN	3337	287	397	170	984	7	13	3	24	11	32	1.0
1-4 YEAR	351	312	421	178	1062	23	32	13	77	39	36	10.3
4-7 YEAR	329	383	491	239	1238	19	26	12	60	32	16	4.9
7-10 YEAR	254	357	509	234	1106	13	20	8	38	21	5	2.0
10-13 YEAR	255	310	356	236	944	8	10	6	25	13	1	.4
13-16 YEAR	252	277	352	137	996	5	7	3	19	9		.0
16-19 YEAR	253	250	415	84	1074	4	7	1	16	7	1	.4
19-22 YEAR	218	227	323	96	972	3	4	1	13	5		.0
22-50 YEAR	2857	225	395	79	832	3	6	1	12	5	4	.1
50-65 YEAR	950	317	410	224	1089	4	6	3	15	7		.0
65+ YEAR	499	363	385	276	1096	5	5	4	16	8		.0
PREGNANT WOMEN	58	380	541	226	1536	5	8	3	20	9		.0
VEGETARIANS	65	466	1104	240	1249	8	18	4	19	13	1	1.5
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	462	1021	270	1249	8	17	4	32	14	1	1.3
IMMIGRANTS (NOT EUROPEAN)	24	202	274	131	690	3	4	2	8	4		.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
FENAMIFOS - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0008 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	42.15	35.04	32.84	107.18	.76	.76	.57	2.02	96	2099	33.8
MEN	2881	40.91	33.64	32.24	102.95	.70	.71	.51	1.84	88	832	28.9
WOMEN	3337	43.23	36.17	33.62	111.17	.82	.79	.61	2.17	102	1267	38.0
1-4 YEAR	351	21.35	19.73	14.74	56.17	1.61	1.48	1.18	4.64	201	231	65.8
4-7 YEAR	329	25.31	25.40	18.04	68.45	1.24	1.32	.91	3.35	155	179	54.4
7-10 YEAR	254	28.67	25.53	22.09	80.17	1.01	.89	.77	2.67	126	121	47.6
10-13 YEAR	255	36.72	34.14	27.86	98.41	.93	.80	.69	2.48	116	109	42.7
13-16 YEAR	252	39.78	29.61	32.78	93.74	.76	.56	.61	1.85	95	95	37.7
16-19 YEAR	253	42.39	44.50	32.25	107.94	.67	.72	.50	1.70	84	65	25.7
19-22 YEAR	218	46.25	49.26	32.56	121.05	.68	.78	.47	1.94	85	56	25.7
22-50 YEAR	2857	45.58	36.24	36.33	113.12	.64	.54	.50	1.61	80	792	27.7
50-65 YEAR	950	48.84	33.35	41.29	114.19	.67	.47	.57	1.61	84	304	32.0
65+ YEAR	499	44.51	27.91	37.88	97.94	.61	.39	.51	1.32	76	147	29.5
PREGNANT WOMEN	58	51.04	37.62	41.72	145.36	.73	.56	.58	1.96	91	20	34.5
VEGETARIANS	65	48.53	40.89	37.35	105.06	.79	.69	.60	2.06	99	26	40.0
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	45.64	38.71	37.06	105.06	.78	.68	.56	2.36	97	29	37.7
IMMIGRANTS (NOT EUROPEAN)	24	38.72	31.89	28.08	100.27	.55	.46	.37	1.29	68	6	25.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
GLYFOSATE - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .3000 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	1150	1406	686	3907	19	18	13	54	6		.0
MEN	2881	1648	1819	929	5478	25	23	18	70	8		.0
WOMEN	3337	720	652	587	1561	14	12	11	34	5		.0
1-4 YEAR	351	373	155	356	629	28	13	27	48	9		.0
4-7 YEAR	329	503	215	465	847	24	11	22	40	8		.0
7-10 YEAR	254	588	232	560	935	21	10	20	33	7		.0
10-13 YEAR	255	639	233	610	1068	16	6	15	30	5		.0
13-16 YEAR	252	719	307	669	1243	14	6	13	25	5		.0
16-19 YEAR	253	1039	974	756	2788	16	14	12	45	5		.0
19-22 YEAR	218	1252	1531	829	4120	18	21	12	55	6		.0
22-50 YEAR	2857	1503	1696	830	5232	20	22	12	66	7		.0
50-65 YEAR	950	1153	1450	711	3324	15	18	10	44	5		.0
65+ YEAR	499	871	784	666	2371	12	10	9	30	4		.0
PREGNANT WOMEN	58	698	300	680	1238	10	4	10	17	3		.0
VEGETARIANS	65	1300	1220	963	3652	20	18	16	54	7		.0
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	1232	1144	862	3652	20	17	16	54	7		.0
IMMIGRANTS (NOT EUROPEAN)	24	1202	1207	688	2748	16	16	9	34	5		.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
HEPTACHLOR - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0001 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	6.16	2.96	5.64	11.63	.12	.08	.09	.29	117	2825	45.4
MEN	2881	6.92	3.23	6.37	12.94	.12	.08	.10	.29	122	1440	50.0
WOMEN	3337	5.50	2.53	5.13	10.13	.11	.08	.09	.28	112	1385	41.5
1-4 YEAR	351	4.02	1.57	3.95	6.66	.30	.12	.29	.54	299	344	98.0
4-7 YEAR	329	4.88	2.08	4.45	8.82	.24	.10	.22	.44	237	312	94.8
7-10 YEAR	254	5.29	2.20	5.12	9.47	.19	.08	.18	.35	188	226	89.0
10-13 YEAR	255	6.28	2.64	6.02	11.09	.16	.07	.15	.28	159	204	80.0
13-16 YEAR	252	6.19	2.65	5.92	10.67	.12	.05	.11	.23	118	143	56.7
16-19 YEAR	253	6.50	3.20	6.07	12.39	.10	.05	.10	.18	102	121	47.8
19-22 YEAR	218	6.95	3.39	6.16	13.24	.10	.05	.09	.18	100	96	44.0
22-50 YEAR	2857	6.51	3.17	5.95	12.40	.09	.04	.08	.17	90	997	34.9
50-65 YEAR	950	6.14	2.73	5.73	10.93	.08	.04	.08	.15	83	238	25.1
65+ YEAR	499	6.36	2.67	5.90	11.66	.09	.04	.08	.16	86	144	28.9
PREGNANT WOMEN	58	6.63	2.75	6.44	11.17	.09	.04	.08	.17	94	21	36.2
VEGETARIANS	65	3.28	1.58	2.92	6.09	.05	.03	.05	.09	53	3	4.6
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	3.40	1.63	2.94	6.30	.06	.03	.05	.12	58	6	7.8
IMMIGRANTS (NOT EUROPEAN)	24	6.80	3.75	6.23	12.58	.09	.05	.09	.17	93	10	41.7

Dutch National Food Consumption Survey 1992 (DNFCS-92)
IPRODIONE - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0600 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	2572	2009	2109	6290	49	53	36	128	82	1609	25.9
MEN	2881	2471	2020	1988	5908	45	53	32	125	76	617	21.4
WOMEN	3337	2658	1995	2223	6490	52	52	40	130	87	992	29.7
1-4 YEAR	351	1694	1463	1329	4198	127	114	94	353	211	249	70.9
4-7 YEAR	329	1972	1728	1532	4922	97	93	76	239	162	204	62.0
7-10 YEAR	254	2025	1776	1741	4718	73	70	61	156	121	129	50.8
10-13 YEAR	255	2089	1358	1737	4516	54	37	48	124	90	85	33.3
13-16 YEAR	252	1970	1451	1595	4639	37	28	29	83	62	43	17.1
16-19 YEAR	253	2097	1650	1798	4882	34	28	28	78	56	32	12.6
19-22 YEAR	218	2144	1455	1851	4859	31	21	27	68	52	24	11.0
22-50 YEAR	2857	2616	2111	2151	6490	37	32	30	95	62	484	16.9
50-65 YEAR	950	3289	2168	2857	7425	45	31	38	112	76	231	24.3
65+ YEAR	499	3218	1908	2882	6649	44	27	39	92	73	128	25.7
PREGNANT WOMEN	58	2800	2198	2207	6932	40	31	30	95	67	11	19.0
VEGETARIANS	65	4185	4686	3444	7791	68	76	57	127	113	32	49.2
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	3974	4386	3262	7791	67	73	54	135	112	37	48.1
IMMIGRANTS (NOT EUROPEAN)	24	2465	1684	1983	5117	34	23	31	70	56	3	12.5

Dutch National Food Consumption Survey 1992 (DNFCS-92)
LINDANE - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0010 mg/kg bw/day

Population	N	ug/day Avg	SD	Median	95%	ug/kg bw/day Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	492.2	276.0	447.5	993.8	9.1	7.1	7.5	20.8	910	6178	99.4
MEN	2881	502.4	288.7	454.7	1027.6	8.8	7.2	7.1	21.0	881	2866	99.5
WOMEN	3337	483.3	264.3	441.3	958.1	9.3	7.0	7.9	20.7	934	3312	99.3
1-4 YEAR	351	289.0	179.7	250.8	627.1	21.6	14.0	18.1	48.8	2160	351	100.0
4-7 YEAR	329	334.5	219.6	298.0	726.4	16.4	11.5	14.2	37.1	1637	327	99.4
7-10 YEAR	254	362.4	211.2	339.4	744.7	12.9	8.0	11.6	25.5	1289	252	99.2
10-13 YEAR	255	399.7	202.7	360.2	779.0	10.2	5.5	9.3	19.6	1022	254	99.6
13-16 YEAR	252	393.7	207.7	363.0	819.3	7.4	4.0	6.5	15.5	745	248	98.4
16-19 YEAR	253	433.9	232.3	402.8	852.2	6.9	4.0	6.5	13.4	691	245	96.8
19-22 YEAR	218	470.4	247.6	434.0	915.1	6.9	3.5	6.4	13.7	687	215	98.6
22-50 YEAR	2857	524.1	284.9	476.8	1027.6	7.3	4.2	6.7	14.9	735	2845	99.6
50-65 YEAR	950	591.3	286.6	546.4	1117.9	8.1	4.1	7.5	15.7	811	947	99.7
65+ YEAR	499	569.1	243.6	539.7	1014.3	7.8	3.6	7.2	13.6	778	494	99.0
PREGNANT WOMEN	58	548.9	288.0	500.2	1114.8	7.8	4.1	7.1	16.1	779	58	100.0
VEGETARIANS	65	755.8	548.1	661.2	1439.5	12.1	8.7	10.8	23.5	1213	65	100.0
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	718.8	527.8	604.2	1458.5	12.2	9.1	10.8	24.4	1217	77	100.0
IMMIGRANTS (NOT EUROPEAN)	24	520.4	283.3	447.9	984.1	7.1	3.6	6.3	12.4	712	24	100.0

Dutch National Food Consumption Survey 1992 (DNFCS-92)
METHIDATHION - DUTCH MRL STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0010 mg/kg bw/day

Population	N	ug/day Avg	SD	Median	95%	ug/kg bw/day Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	244.0	328.0	112.7	868.0	4.5	6.9	2.2	16.3	455	4011	64.5
MEN	2881	202.1	300.3	80.6	757.0	3.6	6.2	1.4	13.2	364	1638	56.9
WOMEN	3337	280.2	346.1	162.8	947.6	5.3	7.4	3.0	17.9	534	2373	71.1
1-4 YEAR	351	140.5	180.5	74.7	492.6	10.6	13.5	5.3	40.4	1061	301	85.8
4-7 YEAR	329	158.3	231.9	71.6	604.2	7.9	12.2	3.5	28.3	786	272	82.7
7-10 YEAR	254	180.3	244.6	83.0	658.3	6.3	8.5	2.9	23.9	633	203	79.9
10-13 YEAR	255	210.5	333.2	86.7	870.4	5.3	7.8	2.1	19.8	527	179	70.2
13-16 YEAR	252	205.8	271.7	75.7	729.1	3.9	5.1	1.4	14.0	391	140	55.6
16-19 YEAR	253	234.8	424.7	86.9	809.0	3.8	6.9	1.3	13.1	376	135	53.4
19-22 YEAR	218	251.8	471.5	59.1	991.0	3.8	7.5	1.0	15.7	379	106	48.6
22-50 YEAR	2857	248.4	341.3	103.5	919.7	3.6	5.1	1.5	13.0	356	1639	57.4
50-65 YEAR	950	310.6	323.6	209.7	987.4	4.3	4.5	2.9	13.5	432	685	72.1
65+ YEAR	499	291.6	278.8	226.3	870.6	4.0	3.9	3.0	11.8	399	351	70.3
PREGNANT WOMEN	58	418.1	445.0	249.4	1361.1	6.1	7.4	3.7	20.5	607	49	84.5
VEGETARIANS	65	389.9	421.9	231.2	1237.0	6.3	6.9	3.8	20.0	631	57	87.7
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	363.6	397.0	231.6	1237.0	6.1	6.7	3.8	20.0	614	66	85.7
IMMIGRANTS (NOT EUROPEAN)	24	258.9	327.8	131.4	835.1	3.8	4.8	1.7	11.1	376	14	58.3

Dutch National Food Consumption Survey 1992 (DNFCS-92)
METHIOCARB - DUTCH MRLS STCRT 91 1997
NTMDI= National Theoretical Maximum Daily Intake (ug/person/day)
ADI = Acceptable Daily Intake = .0010 mg/kg bw/day

		ug/day				ug/kg bw/day						
Population	N	Avg	SD	Median	95%	Avg	SD	Median	95%	average in % of ADI	n>ADI	%>ADI
DNFCS-1992 POPULATION	6218	24.5	43.6	7.3	109.9	.4	.7	.1	1.8	41	775	12.5
MEN	2881	24.2	45.8	6.9	110.2	.4	.7	.1	1.8	39	317	11.0
WOMEN	3337	24.7	41.5	7.5	109.8	.4	.7	.1	1.9	42	458	13.7
1-4 YEAR	351	7.7	15.9	.6	40.4	.6	1.2	.0	2.9	57	61	17.4
4-7 YEAR	329	9.1	17.3	.9	45.0	.4	.9	.0	2.3	45	51	15.5
7-10 YEAR	254	14.1	21.1	4.6	60.4	.5	.7	.2	1.9	48	50	19.7
10-13 YEAR	255	19.4	30.4	6.1	90.7	.5	.8	.1	2.3	49	45	17.6
13-16 YEAR	252	19.6	32.0	5.3	79.5	.4	.6	.1	1.5	37	29	11.5
16-19 YEAR	253	21.9	36.8	7.5	87.5	.3	.6	.1	1.5	35	22	8.7
19-22 YEAR	218	29.2	50.5	9.9	133.3	.4	.7	.2	1.9	43	32	14.7
22-50 YEAR	2857	24.3	40.6	8.1	108.3	.3	.6	.1	1.5	34	267	9.3
50-65 YEAR	950	34.7	59.9	12.7	150.0	.5	.8	.2	2.0	47	136	14.3
65+ YEAR	499	37.2	56.6	13.1	155.2	.5	.8	.2	2.2	51	82	16.4
PREGNANT WOMEN	58	24.5	40.3	7.0	116.6	.3	.6	.1	1.6	35	6	10.3
VEGETARIANS	65	34.3	50.2	6.4	152.5	.5	.7	.1	2.1	52	13	20.0
VEGETARIANS, VEGANS, MACROBIOTIC, ANTHROPOSOPHIC	77	33.2	49.1	5.3	152.5	.5	.7	.1	2.1	50	14	18.2
IMMIGRANTS (NOT EUROPEAN)	24	11.2	17.7	3.8	40.3	.2	.3	.0	.6	16	1	4.2