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Dietary habits and exposure to pesticides in Dutch infants

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SUMMARY

Children are known to have higher dietary exposure levels to pesticide residues than adults due to higher consumption levels per kilogram bodyweight. Also social concern exists on the effects of these residues in young children, who are growing rapidly. To assess whether a certain compound may pose a risk for young children, it is important to have consumption levels of the foods that may contain the compound of interest in this age group. In the Netherlands food consumption data are available of children from 1 year onwards. However, the majority of children (if not all) already consume solid foods before age 1. We therefore conducted a food consumption survey among Dutch infants aged 8 - 12 months. Data on food consumption levels were gathered using the 1-day dietary record method. Weighing scales were provided, so that the amount consumed could be quantified accurately. During the study also duplicate portions of all the foods consumed by the children during the study day were collected. These duplicate portions were analysed for 19 pesticides at the RIKILT - Institute of Food Safety to estimate the real intake of pesticides.

In total 373 infants (186 girls and 187 boys) were studied. The fruit most eaten by this age group was banana (58%), followed by apple (34%), pear (28%) and kiwi (20%). Carrot (18%) was the most favourite vegetable, followed by broccoli (9%) and green beans (8%). Potato was also consumed frequently (49%). Of all the fruits and vegetables consumed by the children large portion sizes (LPs) were calculated at the level of the raw agricultural commodity. These LPs can be used in the point estimate approach to assess the acute dietary intake of toxic pesticide residues in the field of pesticide regulation. The infant food consumption database can also be used for probabilistic modelling of acute dietary exposure.

Of 250 infants the duplicate portions were analysed for 19 pesticides. Of these samples a significant percentage (11%) had a low exposure to one or more pesticides. None of the exposures exceeded the toxicological reference level (acceptable daily intake (ADI) or acute reference dose (ARfD)).

This study among infants resulted in a first impression of actual intake levels of pesticide residues by this age group in the Netherlands via the diet, an estimate of the LPs of fruits and vegetables consumed by young children for use in the point estimate approach and a database with consumption levels useful for probabilistic exposure assessments. Furthermore the duplicate portions collected can be used for the analysis of other compounds that may affect the development of young growing children (e.g. deoxynivalenol (DON), acrylamide, heavy metals).

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1 INTRODUCTION

Dietary intake of pesticide residues has received much attention in the last decade. In both the US and Europe, special attention has been given to children to assess whether the usual procedures for assessing the safety of these compounds also protects this age group. Recently the Health Council of the Netherlands released a report on assessing the risk to children from pesticides in food [1]. It is known that exposures in children are higher than in adults due to higher consumption levels per kilogram bodyweight. Also social concern exists on the effects of residues in very young children, who are growing rapidly. To assess whether a certain compound may pose a risk for young children, it is important to have consumption levels of the foods that may contain the compound of interest in this age group. The Dutch National Food Consumption Surveys, performed in 1987/88, 1992/93, 1998/99, include children above age 1 [2-4]. However, the majority of children (if not all) already consume solid foods before age 1. We therefore conducted a food consumption survey among Dutch infants aged 8 - 12 months.

Why study such small children?
The food and water consumption of infants and children is much higher than that of adults, when expressed per kg body weight [5,6]. One apple of 250 grams containing 0.1 mg of pesticide “X” results in an exposure of 1.7 μg/kg body weight for an adult of 60 kg. For a baby of 7.5 kg, the consumption of only a quarter of this apple results in an exposure of 3.3 μg/kg body weight, which is twice as high. Apart from a higher relative intake, children may also be more susceptible to the effects of some specific harmful substances than adults, because their internal organs are still developing and maturing. Therefore children may be more susceptible to the effects of pesticides than adults, especially for those compounds with the most critical effect in a developing organism [1].

Pesticides may harm a developing child by blocking the absorption of important food nutrients necessary for a normal and healthy growth. Another way in which pesticides may cause harm is, when a child's excretory system is not fully developed, the body may not fully remove pesticides. Also, there are "critical periods" in human development when exposure to a toxin can permanently alter the way an individual's biological system operates[1]. The opinion of the National Research Council on the effects of pesticides in infants and children [5] resulted in stricter regulation on pesticide tolerances in the US. The Food Quality Protection Act (FQPA) of 1996 provides for an additional tenfold margin of safety in setting pesticide tolerances to protect infants and children. The Environmental Protection Agency (EPA) is authorized to replace this tenfold "FQPA safety factor" with a different FQPA factor or to remove it only when reliable data demonstrate that the resulting level of exposure is safe for infants and children [7].

Within the EU, the Scientific Committee for Food [6] reviewed this issue as well and concluded that because of higher consumption levels per kilogram body weight, special attention should be given to this group in risk assessment. For cereal-based foods and baby foods for infants and young

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[1] http://www.epa.gov/pesticides/food/pest.htm

children (including infant formulae and follow-on formulae), maximum residue limits (MRLs) were set at 0.01 mg/kg (Commission Directives 1999/39/EC and 1999/50/EC). The SCF-opinion does not exclude higher MRLs for baby food if it becomes clear from the regular procedure followed for MRL-setting that this does not pose any risk. However, parents are not restricted to give only baby food when weaning. They might prefer preparing food from fresh fruits and vegetables. For many pesticides the MRLs in fresh fruits and vegetables are much higher than 0.01 mg/kg[2]. Whether an infant is at risk when eating fresh foods regularly (not labelled as baby food) can only be assessed by addressing both the level(s) of residue found (in e.g. monitoring programmes) and the amount of food consumed by infants.

Health risks for infants do not only arise from pesticide contamination of food. Food can also, for example, be contaminated with mycotoxins (e.g. deoxynivalenol (DON)) and semicarbenzide. Mycotoxins are natural products that are produced by moulds (fungi), which infest cereal crops and other agricultural products. For example, exposure to DON is associated with the consumption of bread, biscuits and cereals [8]. The most toxic effect of this mycotoxin is growth retardation, which may be particularly of great consequence for this age group. Another potential health risk for infants arises from bottled food. Pesticide levels in bottled food are usually very low, but via the lid of the bottles semicarbazides migrate into baby food [9]. Levels between 3 µg/kg to 26 µg/kg baby food were found. Semicarbazides are considered weak carcinogens, but although the levels were high, the exposure time (about 6 months) is considered too short to add significantly to lifetime exposure [10].

For exposure assessment, data on weight and consumption patterns of infants are needed. In the Dutch National Food Consumption Survey (DNFCS) of 1997/1998 [3], only children above age 1 were included. We therefore conducted in 2000 and 2001 a food consumption survey among Dutch infants aged 8 - 12 months to gather information on food habits of this age group. During the study also duplicate portions of all the foods consumed by the children during one day was collected. Duplicate portions were analysed for 19 pesticides at the RIKILT, resulting in an estimation of the real intake of pesticides by the children.

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[2] http://www.rikilt.wageningen-ur.nl/vws/index.html

2 METHODS

2.1 Study population

The study population consisted of 373 children aged 8-12 months. The infants were recruited via three Dutch child health centres in the middle of the Netherlands in 2000 and 2001. The sampling strategy was designed to include as many children as possible that were fed home-made meals of fruits and vegetables as opposed to manufactured baby food. Children still breast-feeding were excluded from the study due to expected difficulties of collecting breast milk.

2.2 Duplicate diet collection

Carers of the children were requested to prepare a duplicate portion of all meals consumed by the infant during the study day. Duplicate portions were collected in two different clean, leak–proof 1 L polyethylene containers. All fresh vegetables and fruits or food products containing these items were combined in one container and collected separately from other consumed items. In this way possible dilution of pesticides present by food items that do not contain these chemicals was minimised. The containers were placed in cool–boxes with frozen elements or in the participants' refrigerators. At arrival at the institute, containers were homogenised separately. From the fruit and vegetable container an aliquot was collected for laboratory analysis of the pesticides. The samples were stored at –20 °C. Food was collected the whole year round to account for the consumption of all seasonal fruits and vegetables.

2.3 Food diary

Participants were asked to record the food intake during the day of food collection and to weigh and record the quantities consumed. For this the respondents were supplied with a food diary and a weighing scale (g). The consumption of foods as such was translated into the consumption of raw agricultural commodities (RACs) using the conversion model Primary Agricultural Products

Table 1. Pesticides used to validate the probabilistic model and the number of samples with levels at or above the limit of reporting (LOR; 1 $\mu g \cdot kg^{-1}$) in the duplicate diet study (DD), correction factor for recovery, and the range of levels at or above LOR ($\mu g \cdot kg^{-1}$).

compound	number samples above LOR in DD	correction factor for recovery	range of levels in DD ($\mu g \cdot kg^{-1}$)[1]
chlorfenvinphos	3	1.63	2.4 – 14.8
chlorpyrifos	6	2.03	3.2 – 16.8
iprodione	4	1.17	1.2 – 5.5
methamidophos	3	1.10	1.1 – 1.4
pirimicarb	9	5.00	5.0 – 30.7
pirimiphos–methyl	4	2.92	3.2 – 12.0

[1] levels were corrected for recovery

(CPAP), developed at the RIKILT–Institute of Food Safety [11]. For example, if a caretaker recorded consumption of ‘spaghetti baby food’, the model converted this food item into its primary ingredients such as wheat, tomato, pork, vegetable and animal fat, water etc. Body weight was recorded as the weight measured during the last visit at the child health centre prior to the collection day and was corrected for the days between the visit and the measurement.

2.4 Pesticide analyses in duplicate portions

Samples were analysed for 19 pesticides at a limit of reporting (LOR) of 1 $\mu g \cdot kg^{-1}$, as opposed to 10 $\mu g \cdot kg^{-1}$ in methods used in regular monitoring programmes. This low level is important due to dilution of foods containing pesticides with those containing none when collecting duplicate diets. Furthermore, small children consume mainly small amounts of fruits and vegetables after some sort of processing, reducing the probability of detecting pesticide residue levels in duplicate diets. To achieve such a low LOR, a new method was developed at the institute to quantify residue levels as low as 1 $\mu g \cdot kg^{-1}$. Briefly, an extract of the samples was prepared by continuous shaking overnight with acetone, petroleum–ether and dichlormethan. The extract was filtered and after clean–up analysed for pesticides by Large Volume Injection Gas Chromatography. Quality control was performed showing that the recovery was in most cases less than 100% (table 1). However, the recovery was rather variable over eight analytical runs (coefficients of variation were between 36% and 38%). This was due to the sensitivity of the method and its novelty. Exposure calculations were corrected for the lower recovery using a run-averaged correction factor for each pesticide (see table 1; [13]).

3 RESULTS

Table 2 . Characteristics of the study population.

characteristic	girls	boys	total
number	186	187	373
age (d)	306 (23)[1]	306 (24)	306 (23)
weight (kg)	9.1 (0.92)	9.6 (0.91)	9.3 (0.95)
height	72 (2.6)	73 (2.6)	73 (2.7)

[1] Numbers in brackets indicate sd

3.1 Study population

In total 373 infants were studied (table 2). Of 250 children the duplicate diet was selected for the analysis of 19 pesticides. Selection was restricted to those duplicate portions of which the difference in measured weight of the duplicate portion and the weight of the food consumed as derived from the 1-day food diary was equal to or less than 10%. There was no difference in general characteristics and fruit and vegetable consumption according to the food diary between the total population (n=373) and the 250 infants selected for pesticide analysis.

When interpreting the results, one has to keep in mind that due to selection criteria, the results are not fully representative for the whole Dutch infant population.

3.2 Consumption database

Table 3 lists the RACs consumed most by the 373 infants. In this list we included only the consumptions of the fruits and vegetables that were eaten as such. So, for example, we did not

Table 3. Fruits and vegetables consumed most frequently by Dutch infants: percentage of children consuming the RAC[1], the average consumed amount of eaters only (g) and the large portion size (LP; g).

RAC	% consumers	average consumption (g)	LP (g)
banana	58	61	123
potato	49	59	135
apple	34	56	113
pear	28	71	156
kiwi	20	43	77
carrot	18	54	109
broccoli	9	50	149
green beans	8	60	128

[1] RAC = raw agricultural commodity

Table 4. Residue level data of 19 pesticides analysed in 250 duplicate portions of fruits and vegetables consumed during one day by young children (in µg/kg sample).

compound	number of positive outcomes	maximum residue levels in samples (µg/kg)	ADI[1] (mg/kg/d)	ARfD[2] (mg/kg/d)
bromopropylate	0		0.03	-
captan	0		0.1	-
chlorfenvinphos	3	9.08	0.0005	-
chlorpyrifos	6	8.3	0.01	0.1
chlorothalonil	1	3	0.03	-
diazinon	0			
dimethoate	0			
diphenylamine	0			
iprodione	4	4.72	0.06	-
malathion	0			
methamidophos	3	1.3	0.004	0.01
methidathion	1	1	0.001	0.01
parathion-methyl	2	6.6	0.003	0.03
phosmet	0			
pirimicarb	9	6.14	0.02	-
pirimiphos-methyl	4	4.1	0.03	-
procymidon	2	4.3	0.1	-
tolyfluanide	0			
chlorpropham	0			

[1] ADI = acceptable daily intake

[2] ARfD = acute reference dose

include the consumption of banana as processed in baby food or as an ingredient of yoghurt. The average consumption listed is that of only the consumers of the product.

In annex A the complete list of LPs for all RACs consumed is presented. The LP was calculated as the 97.5th percentile (P97.5) of consumption of consumers only. When the number of children that consumed the commodity was 40 or less, the P97.5 consumption level was approximated by the maximum consumption level. The LPs can be used for the calculation of point estimates (IESTI approach) when assessing pesticide exposure for risk assessment purposes. The infant food consumption database can also be used for probabilistic modelling of exposure.

3.3 Duplicate diet study

Pesticides were analysed in 250 daily food samples. A significant percentage of the infants (11%) had a low exposure to one or more pesticides. None of the exposures exceeded the toxicological reference level. Maximum residue levels as analysed in the food samples are given in table 4. In

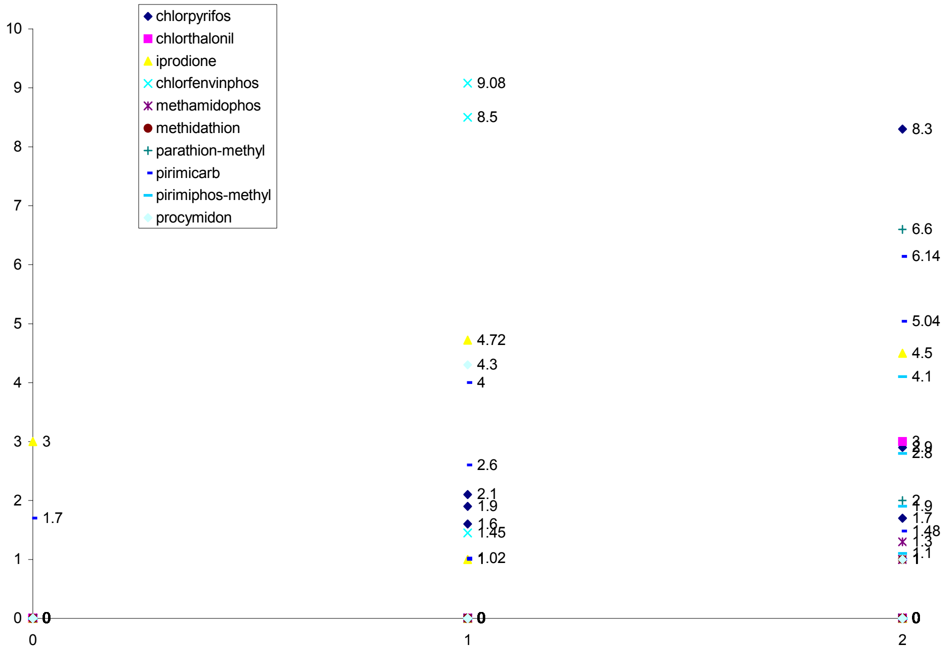

Figure 1. Number of samples with residue levels above the limit of detection stratified by method of preparing the food (0 = not self prepared (n=33); 1 = either fruit or vegetables were self-prepared (n=86); 2= both fruits and vegetables were self-prepared (n=13)).

figure 1, the individual residue levels (in µg/kg) are presented. Pesticide residues were found in 2 (6%) out of 33 samples of not self-prepared food, and twice as much (12%) in self-prepared food.

The results from the duplicate diet study (the 'real' intake) were compared with calculated exposures to the same pesticides using Dutch pesticide residue monitoring results of 2000/2001 and the consumption data of the infant study to validate a probabilistic model for dietary exposure to pesticides. Results of that study are presented elsewhere [12,13]. In short the exposure calculations were performed with both the point estimate approach (using the P97.5 of consumption as listed in table 3 and annex A) and the probabilistic approach). From the comparison it was concluded that the estimated intakes calculated with the probabilistic approach were closer to the 'real' intakes as measured by the duplicate diet method than the intakes calculated with the point estimate approach [12,13].

4 FURTHER USE OF INFANT FOOD CONSUMPTION DATA

4.1 Authorisation of new pesticides

Data from the infant consumption study can be used in risk assessment for the authorization of new pesticides by the Board for the Authorisation of Pesticides (CTB), the European Food Safety Authority, DG Sanco Standing Committee on Animal Health and Chain Management or CODEX-working groups like the JMPR (Joint FAO/WHO Meeting on Pesticide Residues). Table 5 gives an example of this using the Dutch infant food consumption data in the point estimate approach. Characteristics of the study population (average body weight; table 2) and LPs (table 3 and annex A) were used in the calculations. Residue data were derived from field trial studies as reported to the JMPR and are listed in annex B. In the calculations we used a variability factor of 3 as used in 2003 JMPR report [14] and the unit weights used were those reported by the UK to the WHO[3], unless stated differently (table 45). Processing effects were not addressed, because no processing factors were available by the JMPR.

Results showed that both young children and infants had higher intakes of pesticides than adults, due to higher consumption levels per kg body weight. For carrot, broccoli and apple the point estimate of exposure was higher in infants than young children. For carrot and broccoli the LP per kg body weight was higher in infants (carrot en broccoli) resulting in a higher exposure level. However for apple the LP per kg body weight was lower in infants than children. A higher

Table 5. Point estimates of exposure as percentage of ARfD[1] for several pesticide - RAC[2] combinations. Residue data were derived from field trial studies[3].

compound	RAC	UW[4]	general population	children 1-6 years	infants 8-12 months
average body weight (kg):			65.8	17.1	9.3
aldicarb	banana	600	40	144	132
carbaryl	grapes	118[5]	144	382	255
disulfoton	broccoli	474[6]	53	176	307
fenamiphos	carrot	80	19	49	77
methomyl	apple	112	66	226	290
	broccoli	474[6]	407	522	1343

[1] ARfD = acute reference dose
[2] RAC = raw agricultural commodity
[3] For residue levels used see annex B.
[4] UW = unit weight, edible portion, g
[5] UW derived from France
[6] UW derived from USA

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[3] http://www.who.int/foodsafety/chem/en/acute_hazard_db3.pdf (list of 10-02-2003)

Table 6. P99.9 level of exposure (as % of ADI[1]) for two compounds, based on monitoring residue data of 2001 - 2004 and food consumption levels of infants. Variability was included, no processing.

compound	P99.9 (% ADI)
toclophos-methyl (ADI = 0.07 mg/kg bw/day)	0.7
pyridaben (ADI = 0.005 mg/kg bw/day)	6

[1] ADI = acceptable daily intake

exposure level in infants compared to children is due to a combination of the LP and the body weight used, the edible portion size of the commodity addressed and the residue level found. It is therefore not possible to predict beforehand which commodities may pose a greater problem in infants than young children. We therefore strongly advise to calculate the point estimate of exposure for both young children and infants.

4.2 Exposure assessment of pesticides exceeding maximum residue limits

In the last year several pesticides were found in levels above the MRL. In December 2003, January 2004 and September 2004 consumers organisations reported high residue levels on lettuce [15], citrus fruit [16], and lettuce, strawberry and endive [17] respectively. These high values were reported to be most likely unacceptable for young infants because of their potential higher exposure level. RIKILT has performed point estimates of exposure and probabilistic exposure assessments using the reported data in combination with the above reported food consumption levels of infants. In table 5 we report the results from the probabilistic exposure assessment performed using the levels reported in September 2005 [17].

Results from table 6 show no exceeding of the ADI (no ARfD was available for both compounds). Monitoring results for other toxic compounds might result in other outcomes. There is an insignificant year-to-year variation in reported residue levels in fruits and vegetables. It is therefore recommended to perform probabilistic exposure calculations using monitoring data on a regular basis. It was also found in these studies that the exposure via lettuce was insignificant because the infants that participated in the study did not consume lettuce. Citrus fruits were consumed by children (oranges and mandarin). However, the risks were negligible due to a large effect of peeling on the pesticide level.

4.3 Exposure assessment of other chemicals like DON and semicarbazide

Using the amount of cereal, such as wheat and rice, consumed by infants, the exposure to DON (or other mycotoxins like T-2 and HT-2 toxin) can be calculated provided residue data of these mycotoxins are available for these commodities. For DON this is certainly relevant, because the critical long-term effect of elevated DON exposure is growth retardation.

From the 373 infants the number of feedings of foods derived from glass jars and the amount of food consumed from glass jars is known. Semicarbazide is known to migrate into food from the plastic gaskets used to seal glass jars with metal twist-off lids. Of all infants who participated in the study, 252 (68%) were fed bottled food. Consumption of bottled water from glass jars was excluded, because the EU did not mention bottled water as a product of concern. The babies consumed between 1 and 8 different food items from glass jars in 1 day. The amounts consumed per day from the glass bottles ranged from 1 to 1,001 grams. In a worst case, when assuming a content of 26 µg/kg baby food, an infant of 10 kg would be exposed to 2.6 µg/kg bw/d. However, this consumption level was an outlier. The rest of the population consumed between 0 and 514 g of bottled food a day. The National Institute of Public Health and the Environment (RIVM) has set a limit of exposure to semicarbazide at 30 µg/kg bw/d to protect humans from an elevated cancer risk.

4.4 Further analyses in duplicate protions combined with validation of probabilistic approach

The duplicate portions collected in this survey are available for further analyses of compounds. Together with RIVM the samples have been analysed for trichothecenes (including DON, nivalenol, HT-2 and T-2 toxin) resulting in intake levels of these mycotoxins in young children [18]. With this data we will perform a validation study in which we will compare the 'real' intake of trichothecenes (especially DON) to calculated intakes using monitoring data of tricothecenes and food consumption levels of the infant database. These calculations will be performed with the probabilistic approach.

In co-operation with The Food and Consumer Product Safety Authority (VWA) the samples will also be analysed for acrylamide, and at the RIKILT analyses of ochratoxin, nitrate, heavy metals, fatty acid content and composition, protein and carbohydrate content will be performed. With these results 'real' intake levels can be calculated for the different components, which can then be compared to calculated exposure levels using the probabilistic approach.

5 CONCLUSIONS

This study among infants resulted in a first impression of actual intake levels of pesticide residues by this age group in the Netherlands via the diet, an estimate of the LPs of fruits and vegetables consumed by young children for use in the point estimate approach and a database with consumption levels useful for probabilistic exposure assessments. Furthermore the duplicate portions collected can be used for the analysis of other compounds that may affect the development of young growing children (e.g. mycotoxins, acrylamide, heavy metals).

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ANNEX A. Number of infants, average consumption and large portion size (LP[1]) of raw agricultural commodities (RAC) consumed by Dutch infants. Average intake includes only the children who consumed the RAC during the study day.

RAC	# children	consumption (g)	LP (g)	% consumers
almond	2	0.2	0.2	0.5
apple	127	56	113	34
banana	217	61.2	123	58
barley (whole product)	256	2.1	5.3	69
barley (fat)	256	0.04	0.11	69
beetroot	7	49.9	146	1.9
blackberry	1	20	20	0.3
(bleach)celery	2	44.6	67.4	0.5
broad bean (fresh)	1	6.4	6.4	0.3
broccoli	33	49.9	149	8.8
brown bean (dry harvested)	2	13.9	23.2	0.5
Brussels sprouts	7	40.7	50	1.9
buckwheat	222	2.3	5.3	60
cabbage lettuce	1	17	17	0.3
cabbage, red	4	34.1	62.4	1.1
cabbage, white	1	11.9	11.9	0.3
calf, meat of (fat)	4	0.3	0.4	1.1
canola oil	143	3.9	6.5	38
carrot	66	54.1	109	18
cauliflower	25	81.1	160	6.7
celeriac	1	12.4	12.4	0.3
chicken, meat of (whole product)	41	22.3	59	11
chicken, meat of (fat)	41	0.57	3.7	11
chicory	12	71.8	115	3.2
cocoa beans (whole product)	25	0.7	3.4	6.7
cocoa beans (fat)	11	0.5	1.1	2.9
coconut fat	13	5	8	3.5
cod (whole product)	7	27.4	72.2	1.9
cod (fat)	7	0.3	0.7	1.9
courgette	10	50.6	132	2.7
cow, fat of	11	1.6	4.4	2.9
cow, liver of (whole product)	73	2.4	5.4	20
cow, liver of (fat)	73	0.12	0.27	20
cow, meat of (whole product)	135	10.9	48	36
cow, meat of (fat)	135	1.6	6.4	45
cow milk (whole product)	354	155	684	95
cow milk (fat)	336	4.5	19.6	90
cucumber	4	19.5	39	1.1

Annex A *(continued)*

RAC	# children	consumption (g)	LP (g)	% consumers
curly kale	4	64.4	139	1.1
egg, chicken whole (whole product)	77	5.3	34.3	21
egg, chicken whole (fat)	77	0.6	3.6	21
egg, yolk (whole product)	5	1.8	6	1.3
egg, yolk (fat)	5	0.6	2	1.3
endive	12	83.8	145	3.2
fennel	1	88.1	88.1	0.3
French beans (fresh)	3	43	66.1	0.8
gelatine	111	0.04	0.1	30
ginger(root)	1	1.2	1.2	0.3
glucose syrups/malto dextr	67	3	28	18
goat milk (whole product)	1	7	7	0.3
goat milk (fat)	1	1.2	1.2	0.3
grape	5	26.2	48	1.3
grapefruit	2	35.1	49.1	0.5
green beans (fresh)	31	60.3	127.7	8.3
green/(garden) peas	8	34.2	62.1	2.1
hazelnut	10	0.5	2	2.7
honey	5	5.1	11	1.3
horse, meat of (whole product)	1	0.6	0.6	0.3
horse, meat of (fat)	1	0.01	0.01	0.3
johannesbroodpitmeel	40	2.4	6	11
kiwi fruit	75	43.1	77	20
leek	2	53.7	59.3	0.5
lentils	1	11.2	11.2	0.3
maize (whole product)	273	2.6	12	73
maize (fat)	258	0.04	0.13	69
maize germ oil	2	4.5	8	0.5
maize/corn oil	109	4	6.8	29
mandarin, tangerines	14	39.6	67	3.8
mango	1	58.9	58.9	0.3
marrow fat pea	1	28	28	0.3
melon	11	46.2	86	2.9
millet (whole product)	39	3.8	48	10
millet (fat)	39	0.08	1.0	10
mushroom	9	33	71.2	2.4
nectarine	4	45.3	58	1.1
oat (whole product)	258	2.2	7.7	69
oat (fat)	272	0	0.2	73
olive oil	16	4.5	10	4.3

Annex A (*continued*)

RAC	# children	consumption (g)	LP (g)	% consumers
onion	6	10.1	21	1.6
orange	20	50.7	105	5.4
oxheart/conical cabbage	2	80.6	111	0.5
palm kernel oil	143	3.9	6.5	38
peach	4	75.5	132	1.1
peanuts	32	3.4	7.1	8.6
pear	103	71.1	156	28
pig, fat of	11	1.6	4.4	2.9
pig, liver of (whole product)	73	2.4	5.4	20
pig, liver of (fat)	73	0.12	0.27	20
pig, meat of (whole product)	125	8.8	45.2	34
pig, meat of (fat)	125	1.5	6.1	34
pineapple	1	100	100	0.3
plaice (whole product)	1	8.7	8.7	0.3
plaice (fat)	1	0.2	0.2	0.3
plum	6	37.7	62	1.6
pollack, lythe (whole product)	6	20.4	35.7	1.6
pollack, lythe (fat)	6	0.6	1	1.6
potatoes (store)	181	59.4	135	49
pumpkin	1	73	73	0.3
raspberry	2	37	46	0.5
rice (whole product)	309	5.4	26.9	83
rice (fat)	273	0.06	0.25	73
rye (whole product)	270	2.6	11.4	72
rye (fat)	268	0.05	0.14	72
salmon (fat)	2	2.9	3	0.5
sesame seed (fat)	8	0.2	1	2.1
shrimps (whole product)	1	0.4	0.4	0.3
shrimps (fat)	1	0.01	0.01	0.3
soya bean oil	7	0.6	1.1	1.9
soya beans (fat)	11	0.5	2.1	2.9
spinach	12	69.9	102	3.2
stem vegetables (other)	1	11.3	11.3	0.3
strawberry	12	35.3	120	3.2
sugar	282	12	41.2	76
sunflower oil	47	3.4	5.8	13
sunflower seeds (whole product)	1	3	3	0.3
sunflower seeds (fat)	1	1.7	1.7	0.3
Swedish turnip, swede	1	21.8	21.8	0.3
sweet cherries	1	18	18	0.3

Annex A (*continued*)

RAC	# children	consumption (g)	LP (g)	% consumers
sweet corn	1	44	44	0.3
sweet pepper	4	14.7	31.1	1.1
tea, dried leaves/stalks, possibly fermented	33	0.8	4	8.8
tomato	18	37.4	105	4.8
tuna (whole product)	1	2.7	2.7	0.3
tuna (fat)	1	0.04	0.04	0.3
turkey, meat of (fat)	8	1.2	1.5	2.1
turnip tops	1	95.6	95.6	0.3
vegetable & animal oils and fats	115	1.2	7.5	31
vegetable oils and fats	336	2.3	9.3	90
water, lemonade	14	21.1	38	3.8
water, mineral	25	432	814	6.7
water, tap	353	420	784	95
wheat (whole product)	359	19.6	46.8	96
wheat (fat)	348	0.14	0.44	93
white bean (dry harvested)	1	4.5	4.5	0.3
yeast	328	0.5	1.4	88

[1] LP was calculated as the 97.5th percentile (P97.5) of consumption for consumers only. When the number of children consuming the RAC was 40 or less (percentage consumers of about 11%), the P97.5 was approximated by the maximum consumption level.

ANNEX B. Residue levels used for the calculation of the point estimate exposure in table 4.

compound and food	year JMPR report	residue levels (mg$\cdot$kg^{-1})
aldicarb	2001	
banana		0.01(13), 0.02(3), 0.03, <0.03(5), 0.09, 0.1
carbaryl	2002	
grapes		0.42, 2.4(3), 3, 3.3, 3.8, 4.5, 4.9, 5.3, 6.2, 6.5(2), 7.2, 7.5, 7.9, 33
disulfoton	1998	
broccoli		<0.02(6), 0.03(2), 0.05, 0.06, 0.09, 0.11
fenamiphos	1999	
carrot		<0.02(8), 0.02, 0.024, 0.027, 0.05, 0.06(2), 0.07, 0.08
methomyl	2001	
apple		0.16, 0.24, 0.25, 0.30, 0.31(2), 0.32, 0.34, 0.39, 0.40, 0.42, 0.43, 0.48(2), 0.61, 0.68(2), 0.77, 0.91(2), 1.5, 1.6
head cabbage; broccoli; cauliflower; Brussels sprouts		0.04, 0.08(2), 0.09, 0.12, 0.16, 0.18(2), 0.2,0.24, 0.27, 0.45, 0.51, 0.53, 0.64, 0.71, 0.74, 0.76, 0.97, 1.1, 1.2, 1.3(2), 1.6(2), 1.9, 2, 2.1, 2.3(2), 2.6, 2.7, 2.8, 3, 3.1, 3.5, 3.8(2), 4.3, 4.8, 5(2), 5.3, 5.6(2)