RISK ASSESSMENT OF THE DIETARY INTAKE OF LEAD, CADMIUM, MERCURY AND NITRATES IN CYPRUS AND THE RELEVANT UNCERTAINTY

ELENI IOANNOU – KAKOURI

MARIA ALETRARI EFTYCHIA CHRISTOU

State General Laboratory,

Kimonos 44, 1451 Nicosia, Cyprus.

ΓΧΚ
SGL

INTRODUCTION

One of the basic requirements of the new E.U. food legislation for all the Member States is to keep through their official controls (sampling, analysis, monitoring) the concentrations of several chemical substances (additives, contaminants, residues) at safe levels i.e. levels which are acceptable from a toxicological point of view.

For satisfying this requirement, a risk analysis must be done, which includes three basic steps:

- risk assessment
- risk management and
- risk communication.

For the risk assessment of the dietary intake of several toxic substances/contaminants there is a need for two data bases.

- One for the levels of contaminants in the several food groups/items which are consumed in a country or in a region and
- one for the food consumption data for the country or the region.

The more representative and valid are the data for these two data bases, the most "accurate" will be the risk assessment for the examined substances after comparison e.g.

with the values of ADI or PTWI given for these substances by international competent organizations (e.g. WHO/FAO).

In Cyprus, for the first data base, the results of the multiyear monitoring (GEMS/Food Cyprus Programme) and official control of the levels of lead cadmium), mercury and nitrates were used.

For the second data base, the data of the Statistical Service of Cyprus for the Household Budget Survey (HBS) for foodstuffs (for the years 1997-99) were used (8).

The Competent Authority in Cyprus for the official Control of foodstuffs in general, according to the relevant harmonized E.U. legislation, is the Ministry of Health, through its two departments:

(i) The State General Laboratory (SGL) for official laboratory food control, drafting of National Monitoring Programmes and relevant evaluation/assessment of results.

(ii) The Health Services of Medical and Public Health Services (MPHs) for sampling, inspection and enforcement.

For the veterinary controls, inspections and sampling of raw meat and animal products, the Competent Authority is the Veterinary Service of the Ministry of Agriculture Natural Resources and Environment.

Within its above competencies, the State General Laboratory drafts and applies National Monitoring and Control Programmes for additives, contaminants and residues, according to the relevant requirements of the EU legislation.

In this report the results of the two previously mentioned databases and the relevant risk assessment of the dietary intake of

Pb, Cd, Hg and NO3 in Cyprus will be presented. Finally an assessment of the several factors that contribute to the relevant uncertainly shall be done.

EXPERIMENTAL PART

Samples

Representative, as far as possible, samples were collected by the Health Services and Veterinary Services.

For the analysis of Pb, Cd, Hg and NO3 samples of leafy vegetables, wheat, potatoes, milk, meat etc were collected, according to the requirements of the GEMS/Food/Cyprus Programme and the relevant EU legislation (Decisions 93/351/EEC,Directive 2001/22/EC and 96/23/EEC for residues).

Reagents/Quality Control

Suitable analytical reagents, solvents, standards and reference materials (BCR, FAPAS test material, spiked and blank samples) were used for quality control and the laboratory participated in appropriate proficiency testing schemes (FAPAS, etc).

Equipments

- ***Mercury Vaporizer Unit*** **for the measurement of Hg.**

- ***Atomic Absorption Spectrophotometer*****: HGF-AAS (Shimadzu A-G501 Series) for the measurement of Pb and Cd,**
- ***HPLC system*** **Waters 600E: pump Waters 610, Conductivity Detector Waters 431 and LC column IC-Pak A for the analysis of NO3**
- ***Microwave oven*** **: CEM Mars 5**
- **Cutter/Mill: Krups or equivalent**

Methods

For the determination of:

- Pb and Cd the AOAC 999-10 (first action) & a literure (11) method were applied.
- Hg the AOAC 974.14(2000) & EN 13806(2002) were applied.
- For NO3 and NO2 the EN 12014-2:1997 method was applied.

For all the above official methods the State General Laboratory is now accredited according to the EN ISO/IEC 17025 standard.

RESULTS

Food Consumption Data

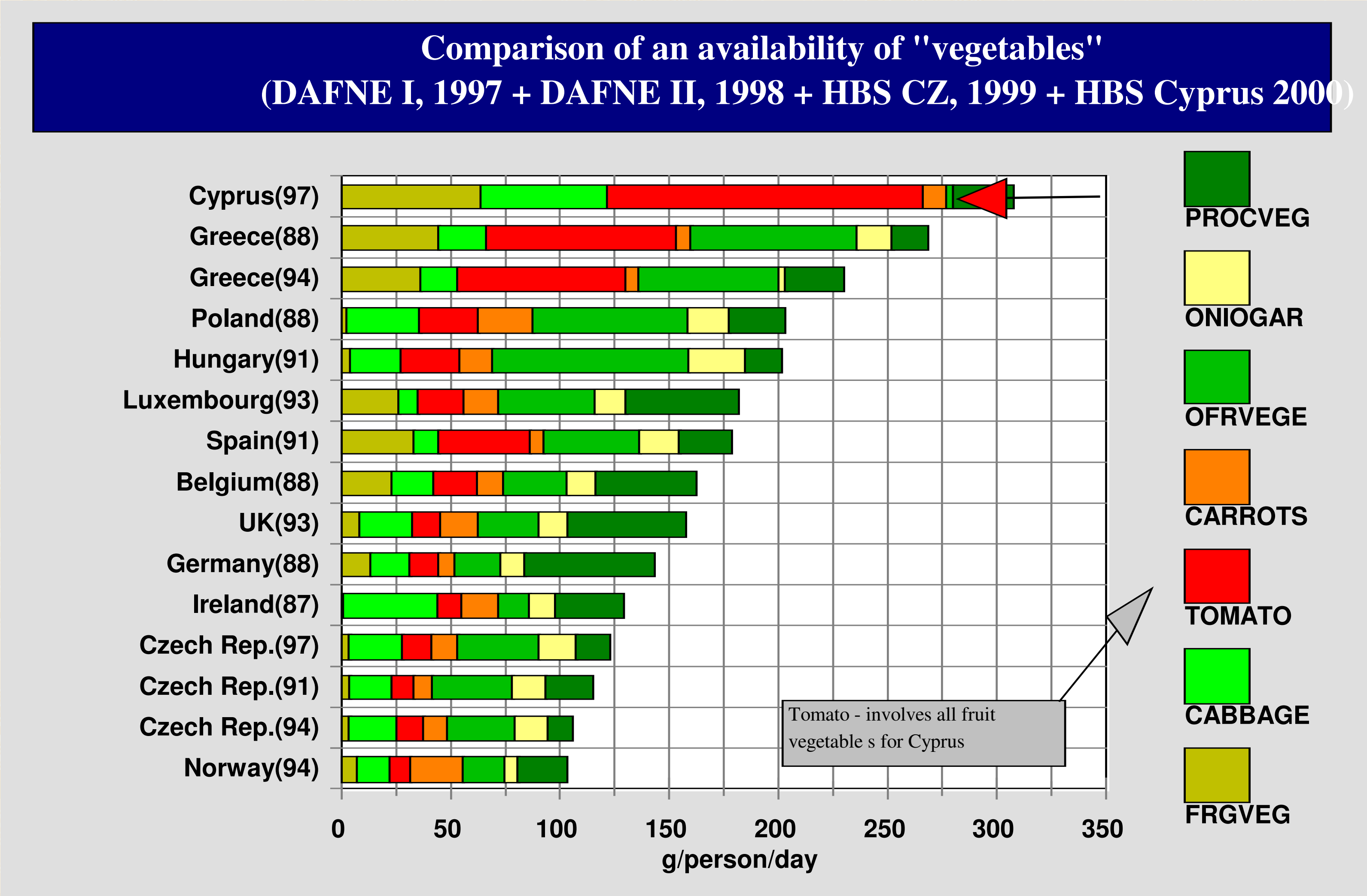
The food consumption data for Cyprus were calculated from the data of the Statistical Service of Cyprus for the Household Budget Survey (HBS) for a family of an average income, for 131 food items for the years 1996-97.

With the help of an expert (*J. Ruprich*) the average consumed quantities for a specific food item were calculated as follows:

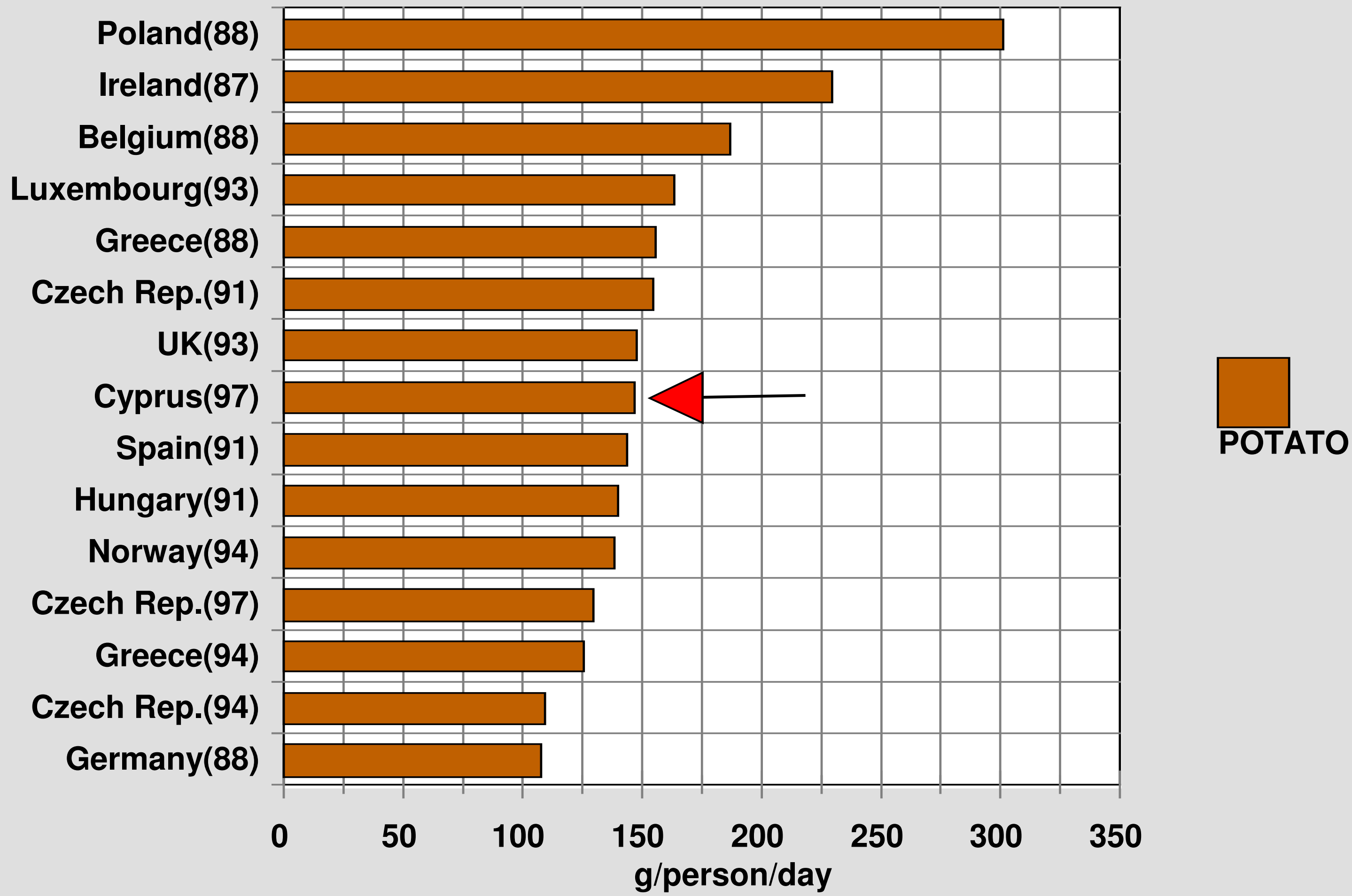
(1) Average Daily Food Availability (g/person/day) = (specific annual expenditure) / (price index per food unit) * (food unit expressed in grams according to priced index) / (365 days) / (3.1 average number of households members).

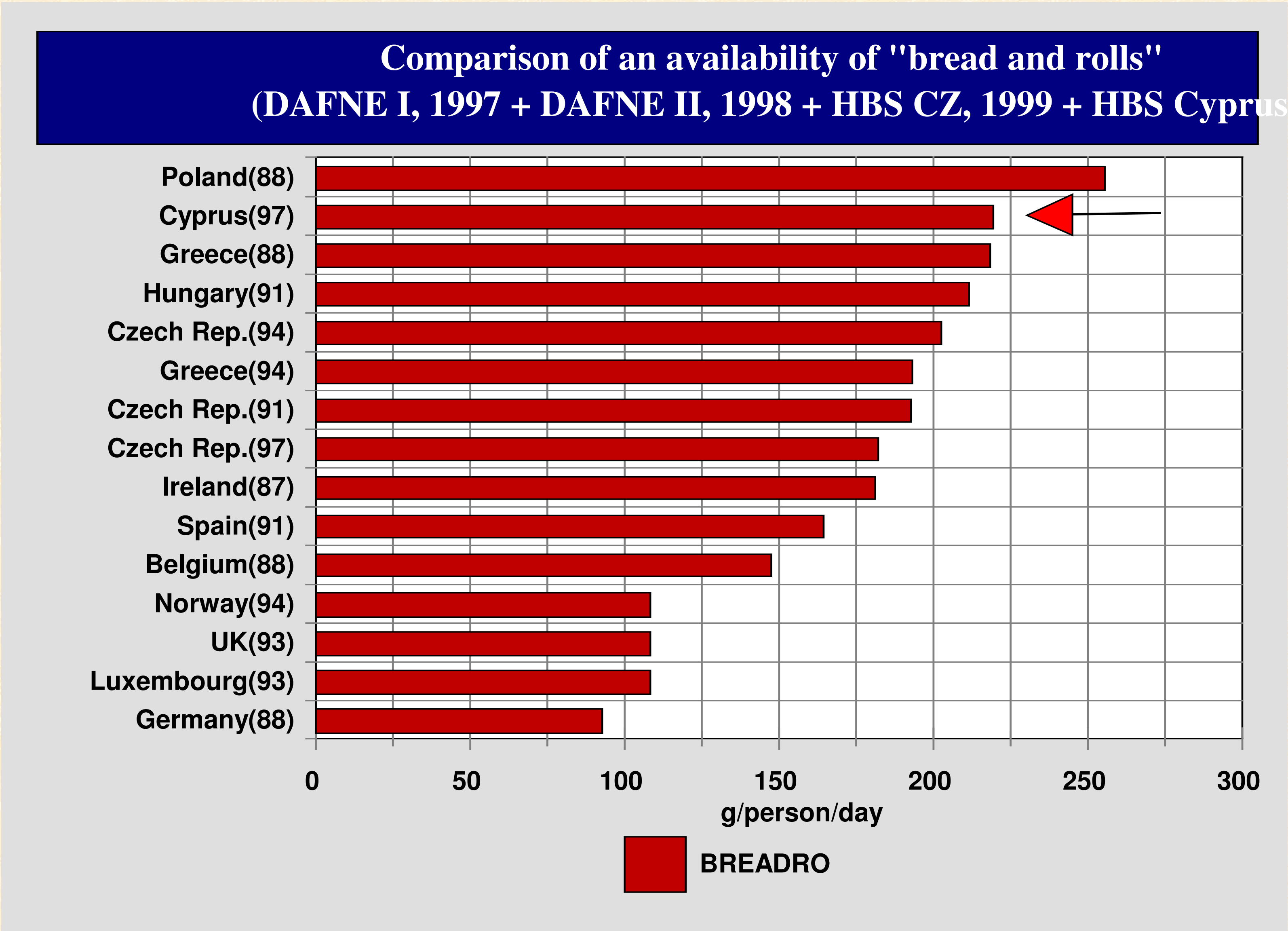
The above food consumption data give information about the average food availability and they exist as a data base in the State General Laboratory.

They are favourably compared with similar results for 11 other European countries especially Mediterranean (DAFNE EU project 1997 for Nutrition and European Eating Habits)

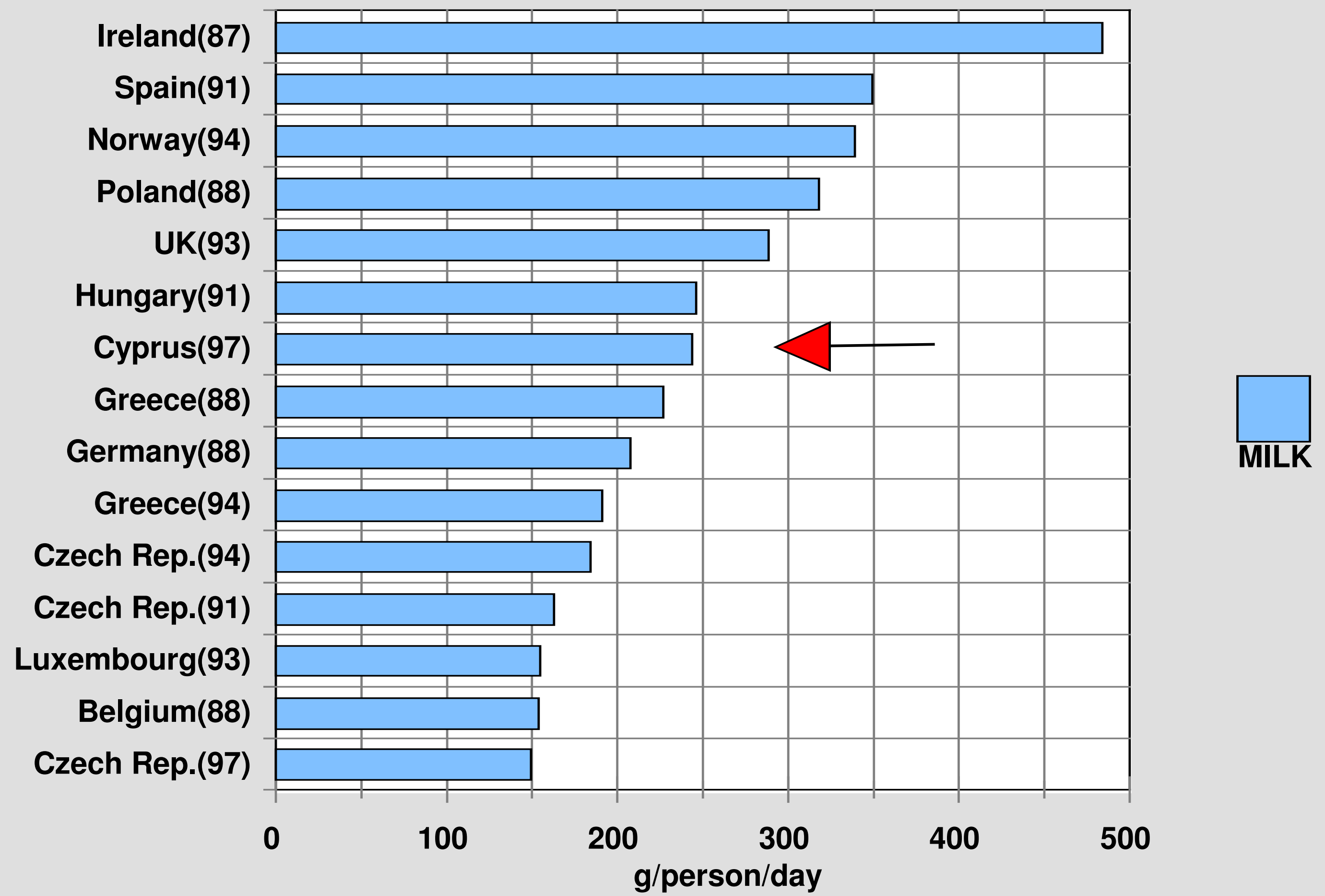

Comparison of an availability of "vegetables"
(DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus 2000)
Cyprus(97)
Greece(88)
Greece(94)
Poland(88)
Hungary(91)
Luxembourg(93)
Spain(91)
Belgium(88)
UK(93)
Germany(88)
Ireland(87)
Czech Rep.(97)
Czech Rep.(91)
Czech Rep.(94)
Norway(94)
0
50
100
150
200
250
300
350
g/person/day
Tomato - involves all fruit vegetable s for Cyprus
PROCVEG
ONIOGAR
OFRVEGE
CARROTS
TOMATO
CABBAGE
FRGVEG

Comparison of an availability of "potatoes"
(DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cypr

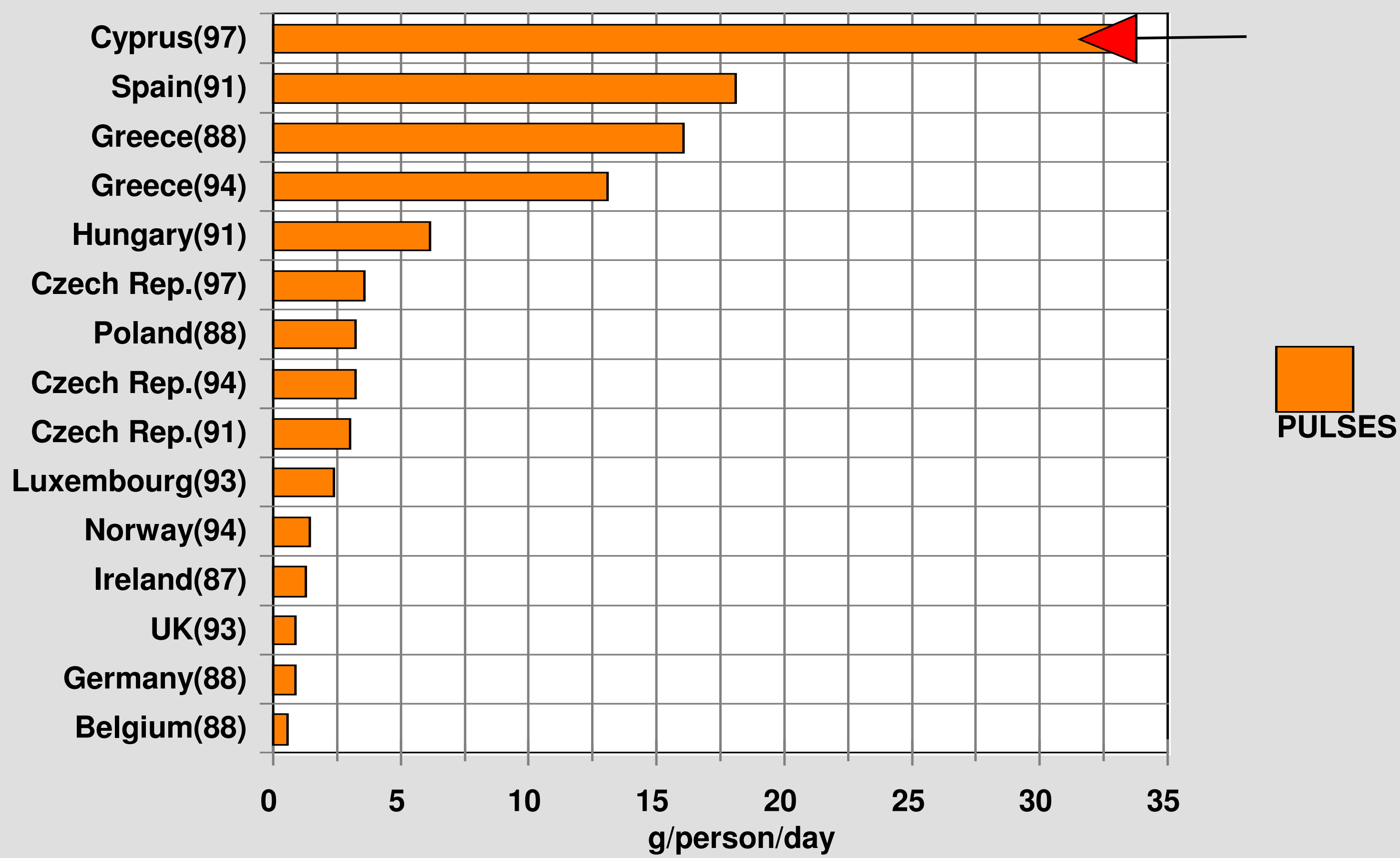



Comparison of an availability of "bread and rolls"
(DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus
Poland(88)
Cyprus(97)
Greece(88)
Hungary(91)
Czech Rep.(94)
Greece(94)
Czech Rep.(91)
Czech Rep.(97)
Ireland(87)
Spain(91)
Belgium(88)
Norway(94)
UK(93)
Luxembourg(93)
Germany(88)
0
50
100
150
200
250
300
g/person/day
BREADRO

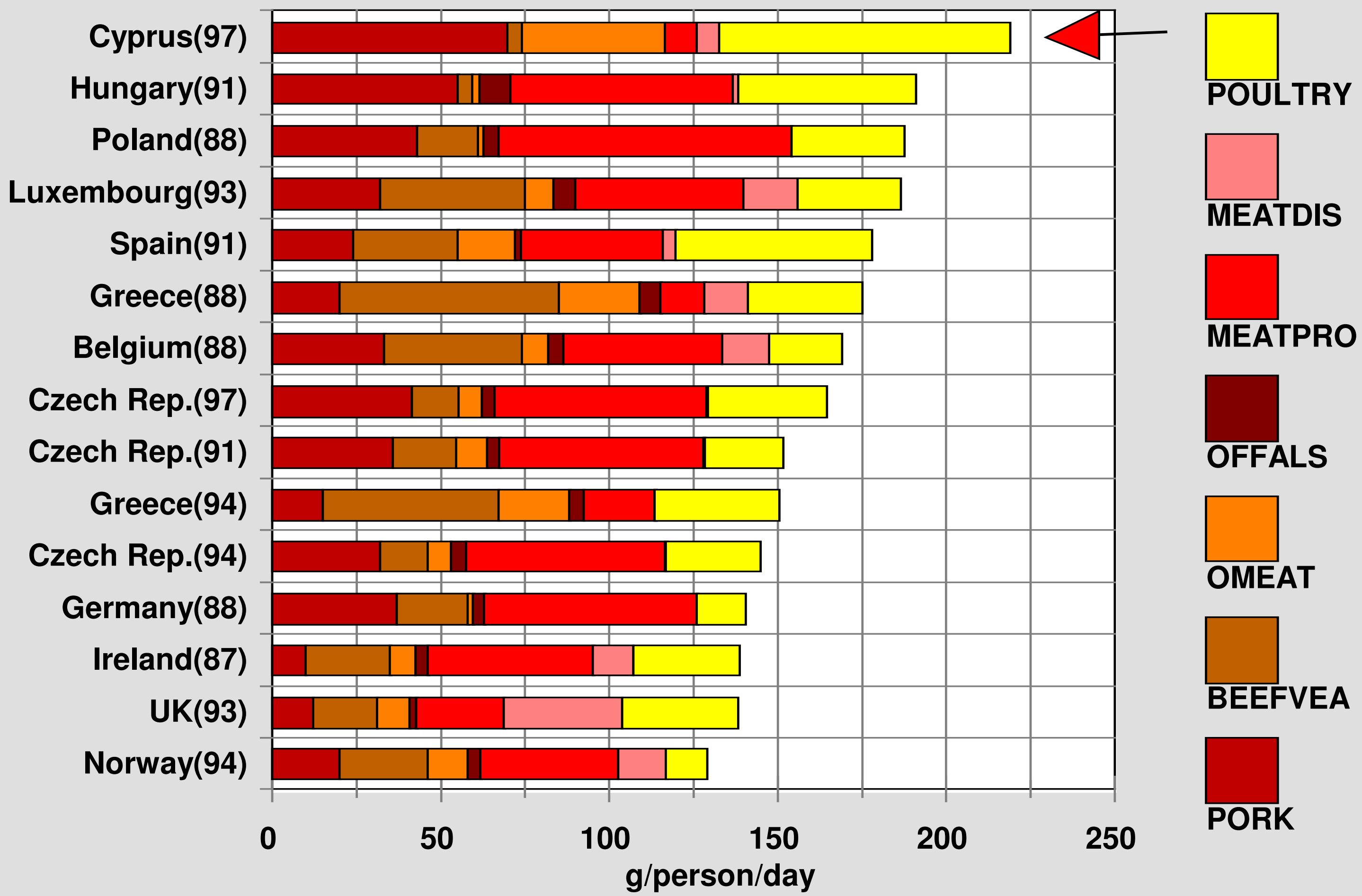
Comparison of an availability of "milk"
(DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus

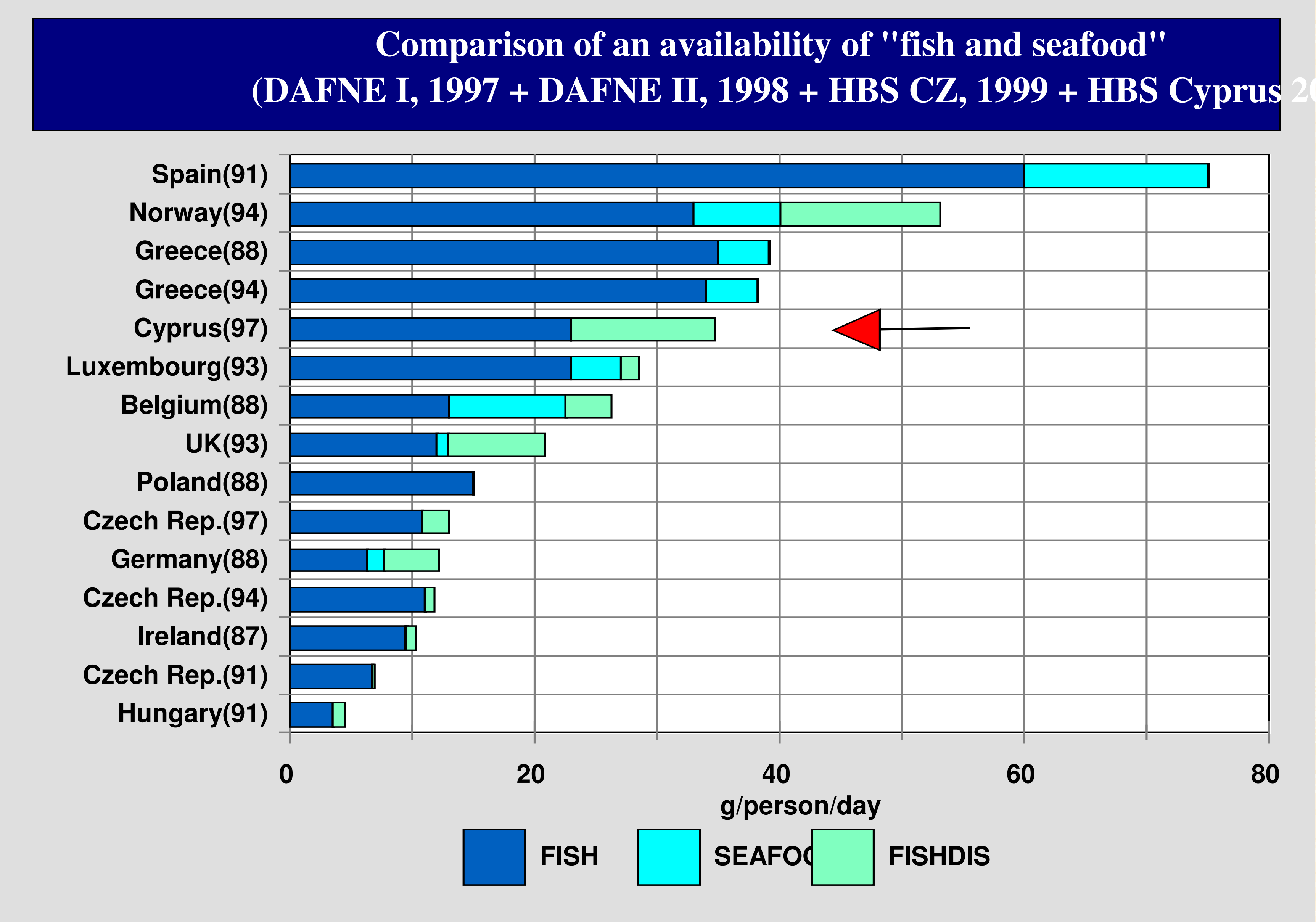


Comparison of an availability of "pulses" (DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus 200



Comparison of an availability of "meat and products" (DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus




Comparison of an availability of "fish and seafood"
(DAFNE I, 1997 + DAFNE II, 1998 + HBS CZ, 1999 + HBS Cyprus 20
Spain(91)
Norway(94)
Greece(88)
Greece(94)
Cyprus(97)
Luxembourg(93)
Belgium(88)
UK(93)
Poland(88)
Czech Rep.(97)
Germany(88)
Czech Rep.(94)
Ireland(87)
Czech Rep.(91)
Hungary(91)
0
20
40
60
80
g/person/day
FISH
SEAFOO
FISHDIS

More specifically the food consumption data used for this report are showed in Tables 1, 2 and 3 for Pb & Cd, Hg and NO3 respectively

. These tables include food groups / items that are the mainly contributing to the intake of Pb, Cd, Hg and NO3, especially for NO3 and Hg.

Table 1: Food consumption data for Cyprus (HBS 1996/97) used for calculation of Pb and Cd intake.

Food group	g/ person /day
Leafy vegetables	63.5
Potatoes	143.9
Wheat & Cereals	334.0
Meat & offal	218.8
Milk	243.0
Fish	34.7

Table 2: Food Consumption data for Cyprus (HBS 1996/97) used for calculation of Hg intake.

Food group	Food item	g/person/ day
Fresh and frozen fish	**Fresh fish**	**7.8**
Fresh and frozen fish	**Frozen fish**	**7.8**
Fresh and frozen fish	**Other fish**	**7.5**
Other fish products	**Canned fish and crustaceans**	**11.7**
	Total	**34.8**

Table3: Aggregation of food consumption data for Cyprus (HBS 1996/97) used for calculation of NO_3 intake.

Code	Food group	Aggregated subgroups	g/person/day
veg1	Vegetables	**Vegetables grown for their fruit (tomatoes, cucumber etc) + garden peas frozen + preserved & processed vegetables**	**151.9**
veg2	Vegetables	**Leaf & Stem vegetables & culinary herbs**	**63.5**
Veg3	Vegetables	**Root crops (carrots etc) and Mushrooms + other frozen vegetable**	**15.4**
Cabbage	Vegetables	**Cabbages, e.g. broccoli, cauliflower etc.**	**57.9**
Potatoes	Vegetables	**Potatoes & products**	**146.4**
		Totally	**435.2**

Levels of Contaminants in Foodstuffs in Cyprus

As mentioned previously the second data base which is needed for the risk assessment, is that with the levels of the several toxic substances/contaminants (range of concentrations, mean values, median, 10% and 90% etc).

The levels of Pb, Cd, Hg and N03 are shown in Tables 4-7 respectively for several foodstuffs (vegetables, potatoes, wheat, fish, meat etc) for the years 1997-2000.

The levels of nitrites in vegetables including potatoes were not detectable (<30mg/kg).

The levels of nitrates and nitrites as additives for cured meat products were within the relevant EU Maximum Limits (ML for NaNO3 is 50-250 mg/kg and for NaNO2 is 100-175 mg/kg, Directive 95/2/EC(6)).

The levels of Pb, Cd, Hg, nitrates and nitrites in drinking water in Cyprus (1999 Survey of SGL from 425 sampling points in several regions)

were <15 mg/kg and <0.003 mg/kg respectively in most of the samples and were very below the relevant EU limit.

Table 4: Levels of lead in foodstuffs in Cyprus (1990, 1997-2000)

Food group item	No. of sample	Concentration (mgPb/kg)				ML[(2)] mg/kg wet
		Min	Mean	Median	Max	
Leafy vegetables						0.3
Fennel	1		0.02			0.3
Coriander	3	0.01	0.18	0.04	0.40	0.3
Beat	1		0.01			0.3
Parsley	24	0.01	0.14	0.11	0.40	0.3
Lettuce	47	0.01	0.06	0.06	0.25	0.3
Mallow	1		0.06			0.3
Rocket	1		0.08			0.3
Celery	25	0.02	0.14	0.07	0.40	0.3
Cubage	1		0.01			0.3

Food group item	No. of sample	Concentration (mgPb/kg)				ML(2) mgPb/kg wet
		Min	Mean	Median	Max	
Spinach	1		0.01			0.3
Other vegetables+*	14	0.02	0.1		0.2	0.1
Beans	1		0.20			0.2
Potatoes	79	0.01	0.11	0.07	0.2	0.1
*Fruits**	23	0.03	0.1		0.2	0.1
Cereals						0.2
Cereals and products*	13	0.05	0.1		0.3	
Wheat**	33	0.05	0.20	0.1	0.3	0.2
Meat						0.1

Food group item	No. of sample	Concentration (mgPb/kg)				ML(2) mgPb/kg wet
		Min	Mean	Median	Max	
Meat & minced meat	12	0.05	0.1		0.2	0.1
Quail meat	2	0.05				0.1
Big animals liver	197	0.04	0.26	0.10	0.60	0.5
Poultry liver	36	0.05	0.13	0.10	0.28	0.5
*Milk**	17	0.01				0.02
*Fish**						
Fresh fish	22	0.05	0.08	0.05	0.23	0.2
Frozen fish*	10	0.05	0.20		0.30	0.2
Canned fish	3	0.05	0.18	0.13	0.37	0.2

Table 5: Levels of Cadmium in foodstuffs in Cyprus 1990, 1997 – 2000

Sample	No of samples	Concentration (mg/kg)				ML mg/kg wet
		Min	Mean	Median	Max	
Leafy vegetables						0.02
Fennel	1		0.025			0.2
Coriander	3	0.005	0.022	0.010	0.052	0.2
Beat	1	0.005	0.031		0.230	0.2
Parsley	23	0.005	0.031		0.230	0.2
Lettuce	40	0.005	0.070	0.040	0.360	0.2
Rocket	1					
Celery	25	0.005			0.024	0.090
Spinach	1					
Cabbage	1					
*Other vegetables**	10	0.005				0.03
Potatoes (with peel)**	58	0.005			0.005	0.15
Bean	1					

*Fruits**	23	0.03	0.1		0.2	0.1
Cereals						0.2
Cereals and products*	13	0.05	0.1		0.3	
Wheat**	33	0.05	0.20	0.1	0.3	0.2
Meat						0.1
Meat & minced meat	12	0.05	0.1		0.2	0.1
Quail meat	2	0.05				0.1
Big animals liver	197	0.04	0.26	0.10	0.60	0.5
Poultry liver	36	0.05	0.13	0.10	0.28	0.5
*Milk**	17	0.01				0.02
*Fish**						
Fresh fish	22	0.05	0.08	0.05	0.23	0.2
Frozen fish*	10	0.05	0.20		0.30	0.2
Canned fish	3	0.05	0.18	0.13	0.37	0.2

** Data of 1990 + Includes tomatoes, cucumbers, onions.*
*** Data of 1996 are included.,*

Table 6 (a): Level of mercury in fish in Cyprus 1999 used for intake calculation

Food group	No. of samples	Concentration mg Hg/kg			
		Min	Mean	Median	Max
Fresh fish	14	0.025	0.192	0.025	2.160
Frozen fish	33	0.025	0.157	0.100	0.390

Table 7: Levels of nitrates in vegetal Cyprus (1997 -1999)

Abbrev.	Time	n samples	Min	10th percentile	Mean	Median	90th percentile	Max
			mg NO3-/kg of sample					
veg1	1997 - 99	6	15	15	332	300	635	687
veg2	1997 - 99	173	279	742	1714	1580	2845	5904
veg3	1997 - 99	53	76	1062	2190	2076	3340	5119
cabbage	1997 - 98	10	243	326	1130	1018	2161	2735
potatoes	1999	32	92	133	258	247	370	722

Risk Assessment

Using the food consumption data of Tables 1-3 and the data for the levels/ concentrations of Pb, Cd, Hg and nitrates of Tables 4-7,

the total intake of these substances was calculated in μg/kg b.w./week for Pb, Cd, and Hg and in mg/kg b.w/day for NO3, for 70kg or 60kg body weight of an adult.

The results of the above calculations were compared with the respective values of PTWI (for Pb, Cd, Hg) and ADI (for NO3). These results are shown in Tables 8-11. The calculations of the daily intake for each substance and for each food group/item were done according to the equation:

(2) μg/kg b.w/day=concentr. (μg/g) x daily consumption (g/person/day) / b.w (kg).

The weekly intake was calculated by multiplying the above result by seven.

Table 8: Total intake of lead in Cyprus 1997-2000

(PTWI of Pb=25μg/kg b.w./week b.w.=70kg)

Food group	Weekly intake, μgPb/kg b.w/week (%PTWI)			
	Min	Mean	Median	Max
Leafy vegetables	0.07(0.3)	0.65 (2.6)	0.38 (1.5)	3.65 (14.7)
Other vegetables	0.42(1.7)	2.24(9.0)	—	6.72(26.9)
Potatoes (with peel)	0.17(0.7)	1.61 (6.4)	0.98 (3.9)	2.80 (11.5)
Meat & offal	1.09(4.4)	2.18 (8.7)		4.38 (0.18)
Wheat & cereals	1.48(5.9)	6.65 (26.6)	3.34 (13.4)	10.02 (40.1)
Fruit	0.84(3.3)	2.8(11.2)	—	8.33(33.3)
Milk	0.24(0.97)	0.24 (0.97)	—	0.48 (0.02)
Fish	0.17(0.7)	0.52 (2.1)	—	1.28 (5.1)
TOTAL	4.5 (17.8)	16.9(67.5)		37.6 (131.8)

Table 9: Total intake of Cadmium in Cyprus 1997-2000

(PTWI of Cd =7μg/kg b.w./week b.w.=70kg)

Food group	Weekly intake, μgCd/kg b.w/week (%PTWI)			
	Min	Mean	Median	Max
Leafy vegetables	0.03(0.4)	0.30 (4.3)	0.18 (2.6)	2.3 (32.8)
Other vegetables	0.13(1.9)	0.58(8.3)	—	0.79(11.3)
Potatoes (with peel)	0.08(1.2)	0.72 (10.3)	0.07 (1.0)	2.16 (30.9)
Meat & offal	0.83(11.9)	1.00 (14.3)	0.83 (11.9)	3.34 (47.7)
Wheat & cereals	0.55(7.8)	1.09(15.6)	—	2.19 (31.1)
Fruit	0.16(2.3)	0.32(4.6)	—	0.97(13.9)
Milk	0.24(3.4)	0.53 (7.57)		0.73 (10.43)
Fish	0.09(1.24)	0.135 (1.93)		0.45 (6.44)
TOTAL	2.1(30.14)	4.7(65.9)		12.9(184.6)

Table 10: Crude total adjusted estimate of the intake of mercury

Exposure doses			10th perc.	Mean	Median	90th perc.
Total Exposure dose from fresh and frozen fish	µg/person/day		0.582	2.707	0.970	3.080
Total exposure dose from fresh and frozen fish	µg/kg b.w./week		0.058	0.271	0.097	0.308
Total adjusted exposure dose from fresh and frozen fish (adjustment from availability of fresh and frozen fish 15.6g >>> total fish 35g)	µg/kg b.w./week b.w=70kg	Multiplying by factor 2.24	0.130	0.610	0.217	0.690
% PTWI (MeHg = 1.6 µg/kg b.w./week)			8.1	38.1	13.6	43.1
% PTWI (Hg = 5 µg/kg b.w./week)			2.6	12.2	4.3	13[illegible]

Table 11: Crude estimate of nitrates intake in Cyprus 1997-1999

Abbrev.	Analytical results for time period	10th percentile	Mean	Median	90th percentile
veg1	1997 - 99	0.1	50.4	45.6	96.5
veg2	1997 - 99	47.1	108.8	100.3	180.7
veg3	1997 - 99	14.7	30.2	28.6	46.1
cabbage	1997 - 98	18.9	65.4	58.9	125.1
potatoes	1999	19.5	37.8	36.2	54.2
Total dose mg/person/day, 70kg.b.w.		100.2	292.7	269.7	502.5
Total dose mg/kg b.w./day		1.4	4.2	3.9	7.2
%ADI (3.7 mg NO3-/kg b.w./day)		37.8	113.5	105.4	194.6
%RfD (7 mg NO3-/kg b.w./day)		20.0	60.0	55.7	102.9

DISCUSSION

Lead and Cadmium

As shown in Tables 4 and 5, the levels of Pb and Cd for several foodstuffs e.g. vegetables, fruits, potatoes, wheat and cereals, meat, offal, milk and fish for the years 1997-2000, were in most cases within the relevant limits of the Cyprus and E.U. legislation [(2)].

Only a few samples of leafy vegetables, potatoes and cereals were near or above the relevant MLs. This is due to the general environmental contamination especially for Pb, as in that years (1997-2000) and in previous years, the use of leaded petrol was permitted till 2003.
In 2004 Cyprus became a member of E.U. so the use of leaded petrol was forbidden. More recent analytical results for leafy vegetables and other locally produce plant origin foodstuffs, show lower values for the concentrations of Pb and Cd.

More samples must be analyzed to monitor the trends of these levels.

Fig. 1a - Mean Levels of Pb in leafy vegetables

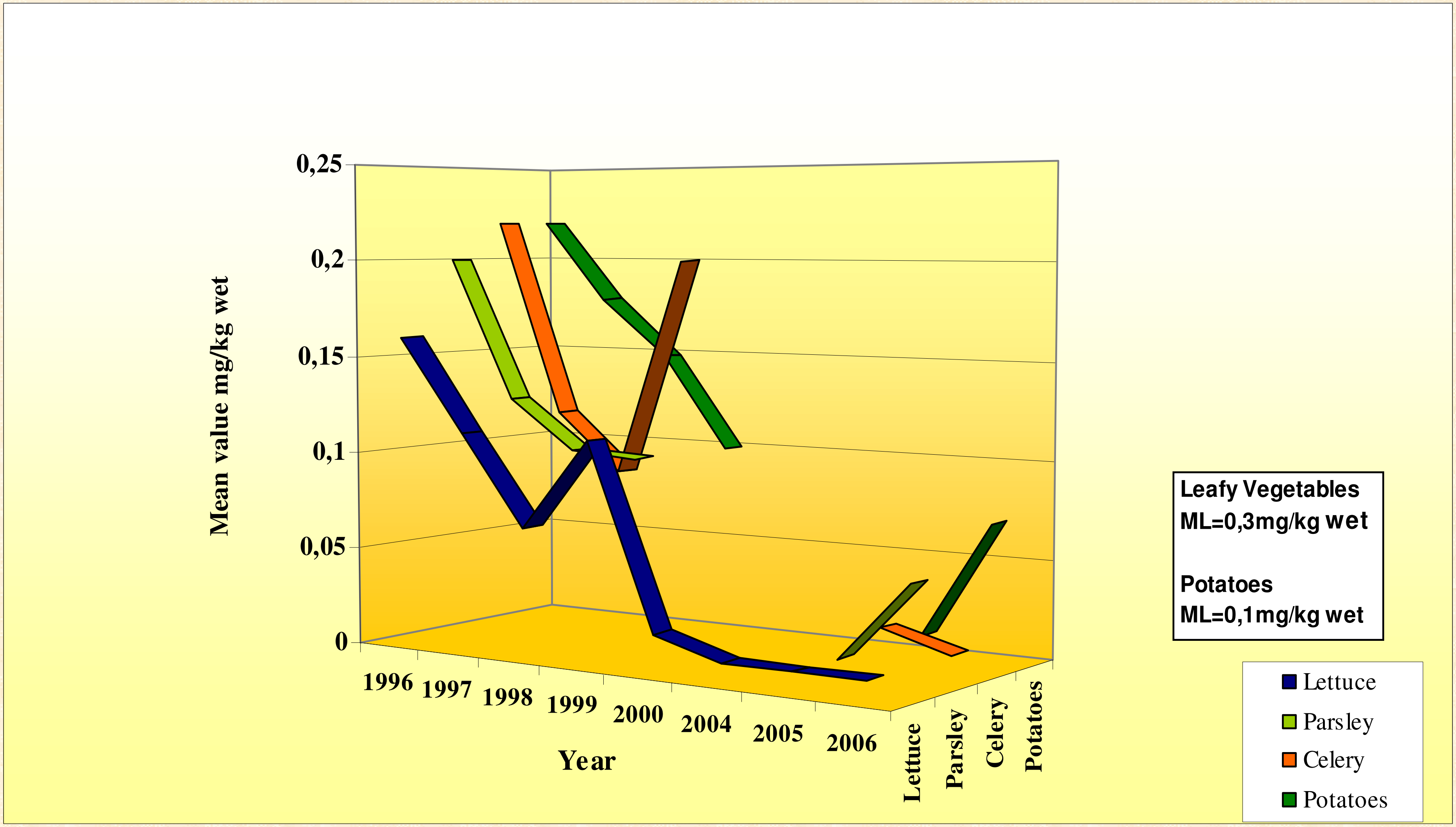
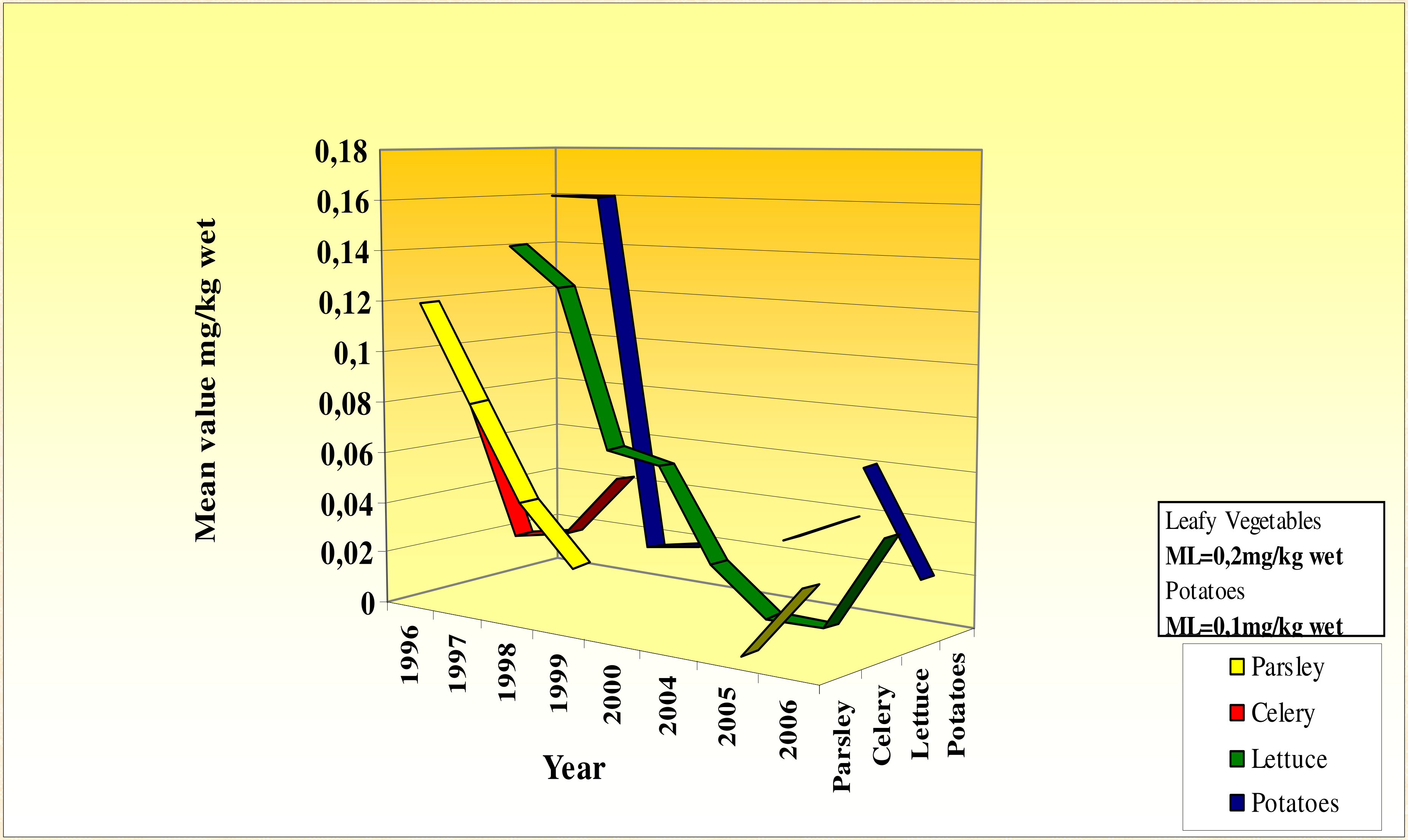


Fig. 1b - Mean Levels of Cd in leafy vegetables



From the data of Table 8, the greater contribution to the dietary intake of lead is due to the group of cereals and is ~26% of the PTWI of Pb. This is in accordance to the results for other E.U. countries.

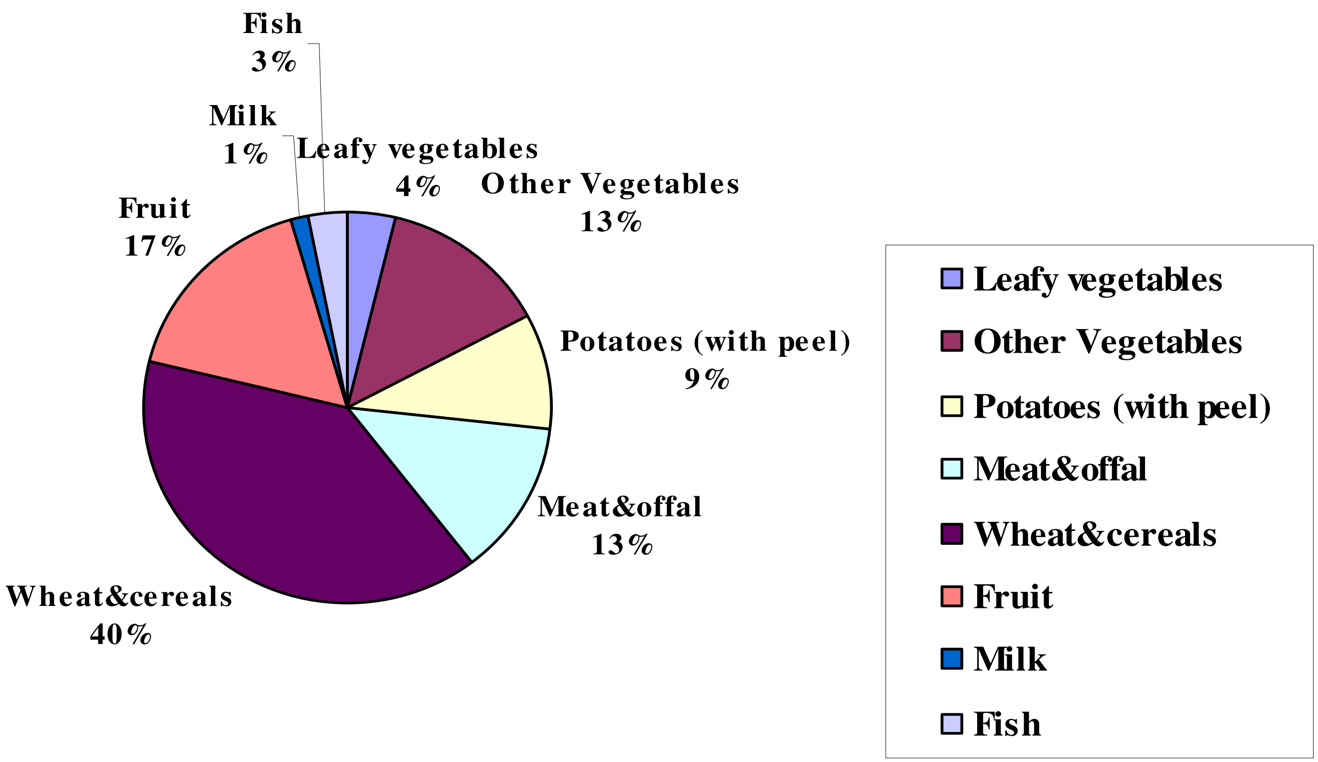
The contribution of drinking water to Pb and Cd is negligible as their levels in drinking water are not detectable.

From the data of Table 8 we see that

the average total intake of Pb is ~67% of the PTWI for 70 kg. b.w. calculation.

In the above calculations the contribution of other food groups/items e.g. pulses, oils and fats, eggs, drinks, was not included due to the lack of relevant analytical data.

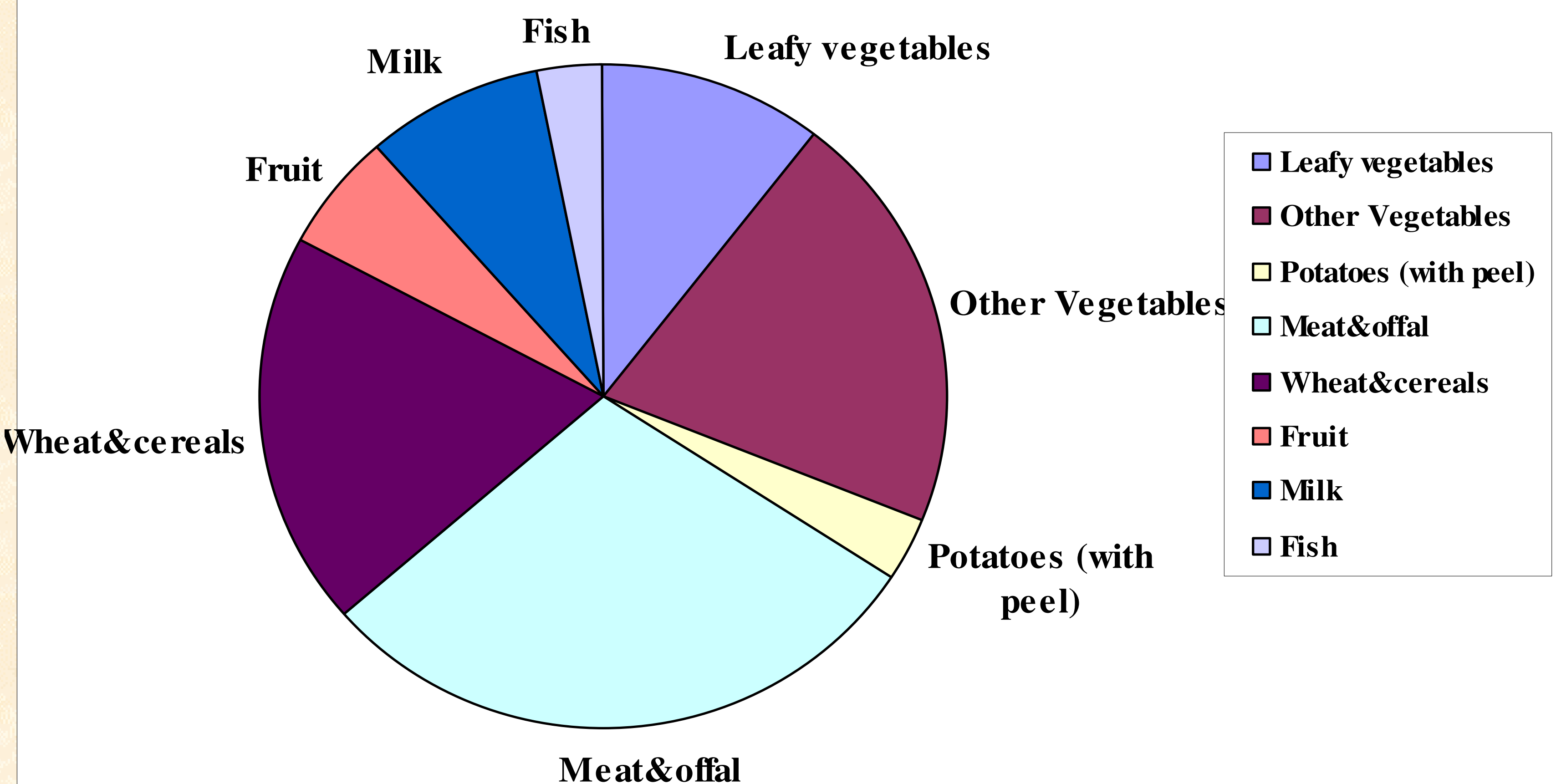
Total intake of Lead in Cyprus 1997-2000



From the data of Table 9 for Cd, the greater contribution to the dietary intake of Cd, is due to meat and cereals, following potatoes, fish and other foodstuffs.

The average total intake of Cd is about ~ 66 % of the PTWI of Cd for an adult of 70kg b.w or 76% PTWI for 60kg b.w. calculations.

Total intake of Cadmium in Cyprus 1997-2000

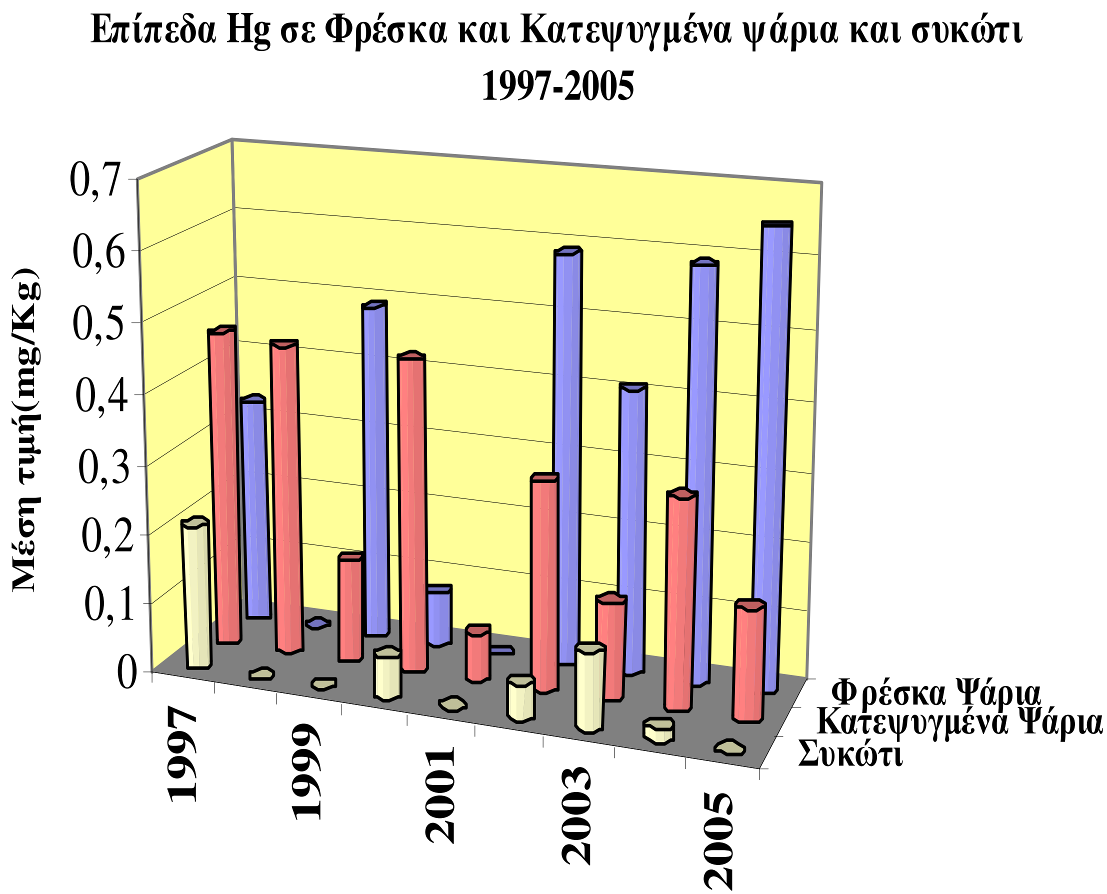


Mercury

From the data of Table 6 and 6a the levels of Hg in several types of fish, fish products and mollusks except some samples of big fishes e.g sward fish, which were above limit.
were within the relevant E.U. MLs:

0,5mg Hg/kg for fish generally
1,0 mg Hg/kg for specified big and carnivore fish

Fig. 2 - Mercury levels in fish, frozen fish and liver



The main rout of entry of Hg in the human body is the fish, fish products and mollusks.

So for the calculation of dietary of Hg, the data of Table 2 for the consumption of fish and the data of Table 6 for the levels of Hg, were used.

As seen from the data of Table 10, the average total intake of Hg is for 70kg b.w. calculations about 12% PTWI of Hg and ~38% PTWI of Me-Hg, to which the inorganic Hg is transformed in the body of fish.

The Me-Hg is more toxic than inorganic Hg[13]. For 60kg b.w. calculations, the average intake of Hg is ~14% PTWI of Hg and ~44% PTWI of Me-Hg.

These values are comparable with those of other E.U. countries, for which the consumption of fish is not too high, but for some E.U. countries (e.g. Norway) where the consumption of fish is high, the PTWI of Hg may be exceeded (SCOOP task of E.U. for heavy metals).

- **Due to these data the European Food Safety Authority (EFSA) has given an opinion for Hg and Me-Hg and advice the population of these countries to consume less fish, especially the pregnant women and children.**

Nitrates

The levels of nitrates in vegetables, ranged from <30mg/kg to 5904 mg/kg, with the leafy green vegetables (spinach, coriander, lettuce, parsley etc) having higher values of nitrates than the other vegetables, being in some cases near the relevant EU MLs for spinach and lettuce.

The MLs of nitrates, for spinach are: 2500-3000mg/kg and for lettuce are: 2500-4500mg/kg, depending on the season and if they grow under cover or not.

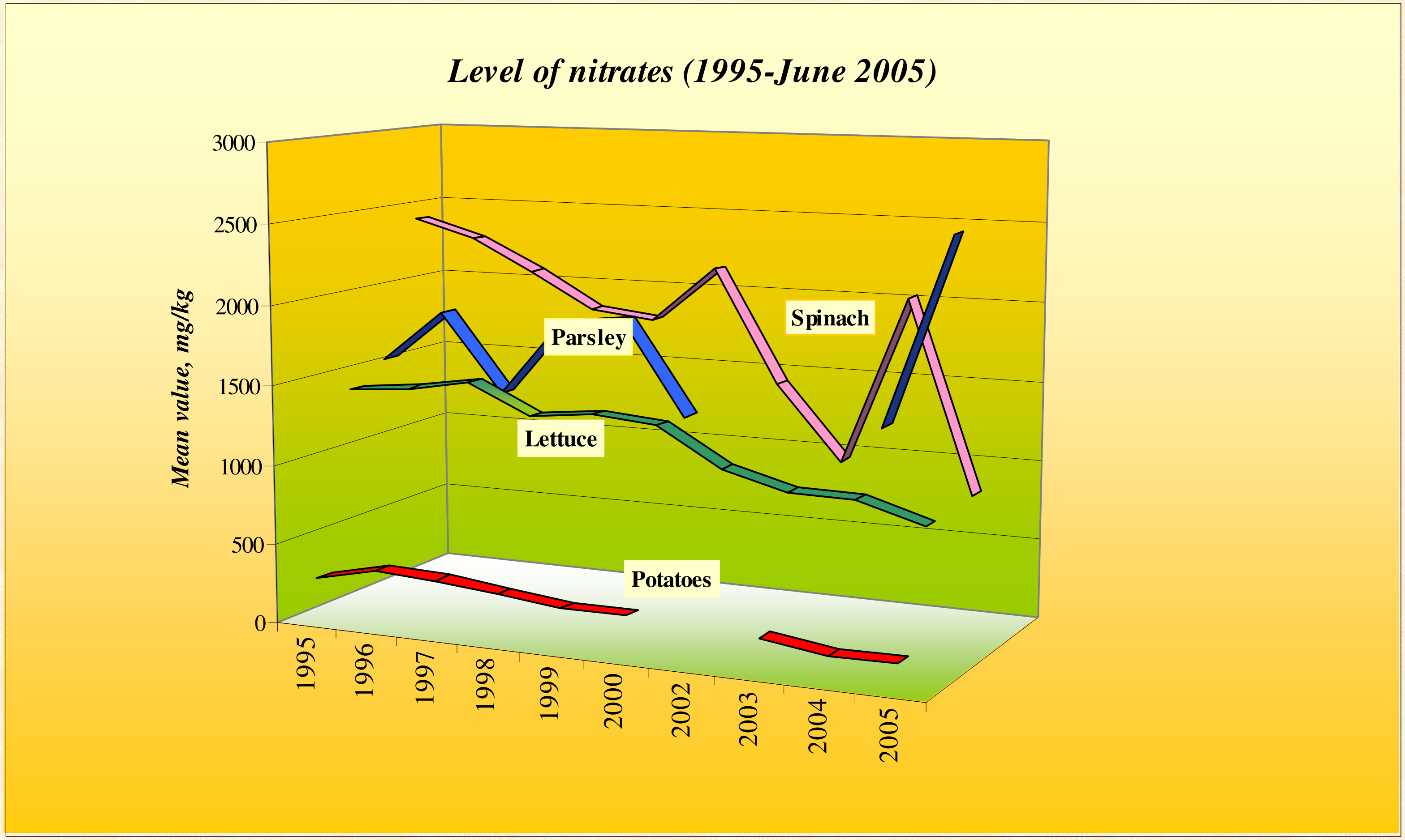
The levels of nitrates in frozen spinach and some boiled vegetables, in tomatoes, cucumbers, potatoes and baby food are much lower (<400mg/kg and <30-97mg/kg of)

ΓΧΚ
SGL

During recent years a decrease in nitrate levels in potatoes, spinach celery and lettuce is observed, due most probably to better agricultural practices applied during the years 1999-2006 (Fig. 3).

The levels of nitrates in vegetable and potatoes must be reduced as they are a part of healthy diet!

Figure 3: Levels of nitrates 1995 - June 2005



As the levels of NO_3 in drinking water and in cured meat products were low,

so the contribution of these groups (0.02g cured meat and 2 Lt water/person/day) to the intake of nitrates is low, compared to the contribution of vegetables.

The major source of nitrates in the diet results from vegetables and potatoes [2]**. Having in mind all the above**

the calculated average exposure dose to nitrates (Table 11) is about ~100% ADI of NO_3 (ADI=3.7mg/kg b.w./day).

The levels of nitrates in vegetables and potatoes must reduced as they are a part of a healthy diet.

ΓΧΚ SGL

This comparison is only for orientation, because the consumption data for vegetables are approximate and we have few analytical data for some vegetable items.

Nevertheless these data, lead to the preliminary conclusion that the high consumption of vegetables which is a characteristic of a healthy Mediterranean diet, as the Cypriot diet is, leads to a high intake of nitrates and may be of other contaminants.

This however is most probably counteracted by the beneficial to the health ingredients of vegetables (risk/benefit assessment).

From this point of view, the ADI for nitrates may not be applied, when vegetables are assessed.

Nevertheless the levels and use of nitrate fertilisers must be reduced, as low reasonable achievable (ALARA principle).

Uncertainties

Having in mind all the above,
the estimated intakes of Pb, Cd, Hg and NO_3 have great variations
and range between 50% and 150% (for the higher consumers) of the average calculated intakes of PTWI or ADI and have high uncertainties.

The sources of uncertainties

are due to the uncertainties of individual components of the equations of their calculation i.e. the equation

(1) for calculation of food consumption data

(2) for the calculation of dietary intake from each food item.

More specifically, the most basic sources of uncertainties are:

- The approximations in the calculation of food consumption data. The HBS method is not very accurate as it is based on the yearly expenditures of a household but is better than others (e.g. food balance sheets).
- The uncertainties of the mathematical modelling used for risk assessment.

- For some food items the analytical data were very few or didn't exist.
- The uncertainties of the analytical methods/data for several contaminants.
- The calculations were done for adults with a body weight of 70kg or 60kg. If they were done for a baby e.g. 15kg b.w. the intakes may be were higher but the probability adverse effects could be higher as the children are more sensitive.

CONCLUSIONS

Despite the uncertainties of risk assessment for the dietary intake of several substances, this must be done, using as far as possible more accurate methods, so as to be more “accurate” the risk assessment and to be taken more proper correcting or preventing measures when needed.

For Cyprus, the above estimation has shown that the average total intake for 70kg b.w. of an adult is:

for Pb 67% PTWI
for Cd 66% PTWI
for Hg 38% PTWI of MeHg
for NO3 ~100% ADI or 60% RfD (of USA).

These values are greater than the respective average intakes in several EU countries [3].

Having in mind all the above data, the effort must be directed towards the application of:

- *Codes of Good Agriculture Practice* (lower use of nitrate fertilizers, rotation of crops, integrated crop management) and better environmental practices (lower emission etc) for better protection/sustainability of the environment (6c) and safety of foodstuffs,
- *Proper risk management*, by keeping the permitted Maximum Levels (MLs), of several contaminants/pollutants in the environment (6c) and in foodstuffs as low as reasonable achievable (ALARA principle).

• *Give dietary guidelines* to the consumers about eating less leafy green vegetables (which contain higher levels of nitrates) and a variety of the other vegetables.

• *more accurate food consumption data* must be produced,

• more samples of several food items must be analyzed with *sensitive validated analytical methods*,

so as to have lower uncertainties in the risk assessment.

Acknowledgements

To my Director ***Dr.Costas Michael***

My colleagues of SGL
Mrs Eleni Procopiou, Mrs Eleni Loizou, Dr. Maria Christophidou, Mrs Stella Soteriou, Mrs Athina Koliou, Mrs Markella Cristodoulou, Mr Dimitris Stefani

Mrs Agathi Anastasi ***head of the IT unit of SGL***

ΓΧΚ SGL

Thank you very much for your attention!

ΓΧΚ
SGL