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Market Basket 2010

– chemical analysis, exposure estimation and health-related assessment of nutrients and toxic compounds in Swedish food baskets

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Preface

This report presents results from a Swedish market basket survey, which started and with food purchased in 2010 (Market Basket 2010). The document meets the ambition of the National Food Agency (NFA) to give an integrated presentation of all the results produced so far within the Market Basket 2010 project, both regarding nutrients and food contaminants. Additional studies on banked food samples from this survey are expected to appear later, but are dependent on future interest and financial resources.

In this report the following compounds have been analysed and their supplies, or estimated per capita exposures, have been assessed: total fat and fatty acids, carbohydrates, vitamin D, minerals and toxic metals, persistent organic pollutants (POPs), pesticides, and polycyclic aromatic hydrocarbons (PAHs). When possible, the per capita exposures were matched against health-based reference exposure values, and potential health outcomes were assessed.

At NFA, experts from different disciplines have worked with the production of the present document and the following persons, and their respective contributions, are acknowledged.

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Document version information

Version	Date	Corrections
3 (present)	31 Oct. 2012	Table 12.1:1 - Vitamin D data: addition of one missing data point (“s-p cereal prod. 0.11”)
2	21 Aug. 2012	Annex J – Completion of the table (only half included in version 1)
1	30 May 2012	

1. Summary

Market basket surveys have been performed by the National Food Agency with the purpose of obtaining information on levels of nutrients and potentially harmful components in commonly consumed food products or food groups. It has been the ambition of the Agency to conduct these studies at about a five-years interval, and earlier market basket studies have been performed in 1987 and 1994, with focus on radioactive cesium from the Chernobyl accident, and in 1999 and 2005, using a similar method and scope as in the present study. In this study, Market Basket 2010, we collected food baskets from five Swedish major grocery chains by using a shopping list based on per capita food consumption data derived from production and trade statistics. For fish and fats and oils more detailed statistics on household purchases, obtained from a market research company, were used. Two types of baskets were purchased at each grocery chain, mirroring the standard price and the low price assortments. The food baskets were purchased in Uppsala in May-June 2010, but as the type of products could shift from spring to autumn regarding fruits, vegetables and potatoes, these groups were also purchased in autumn the same year.

The purchased food baskets contained specific food items or categories that have a mean consumption of at least 0.5 kg per person and year. This means that approximately 90 % of the so called “direct consumption” is covered by these market baskets, when expressed on the basis of food weight. Based on the food categories included in the per capita statistics, a detailed shopping list was produced and followed at the purchase event. The items in the market baskets were subsequently divided into 12 food groups, based on an ordinary sorting of food products commonly found on Swedish market. Homogenates of each food group were analysed for selected compounds and the supply, or per capita exposure, was calculated. Additional samples of each food group homogenate were stored at -20^{o}C to enable future analyses of additional compounds.

Both nutrients and toxic compounds in food have been analysed in the food baskets, and this report includes data on levels in food groups of total fat and fatty acids, carbohydrates (sugars, starch, dietary fibre), vitamin D, essential minerals and toxic metals, persistent organic pollutants (POPs), pesticides, and polycyclic aromatic hydrocarbons (PAHs). For the above-mentioned food components or contaminants, food per capita exposure data were calculated, which were assessed against health-based recommendations of supplies of nutrients and tolerable/acceptable exposures of contaminants.

Fat and fatty acids

The average total fat supply in the baskets was 116 g per person per day with small variation between standard and low price baskets. The main food groups contributing to total fat were fats (23 %), meat (21 %) and dairy products (19 %). Pastries contributed 9 %, and sugar and sweets 13 %. Compared to the market basket survey from 2005, the

present per capita exposure to total fat was higher. Estimating a per capita supply of energy of about 12.5 MJ per person and day, total fat provided 34 % of the energy (E%), which is close to the upper bound of the recommended intake range of 25-35 E%. The contribution of saturated fatty acids (SFA), mono-unsaturated fatty acids and poly-unsaturated fatty acids in the current market basket - 14, 12 and 4.4 E%, respectively - was at a similar level as in the market basket from 2005. The estimated exposure to trans-fatty acids (TFA) was 1.7 grams per person and day, a minor decrease from 2005. The TFA exposure corresponds to about 0.5 E%, which is clearly beneath the WHO recommendation saying that not more than 1 % of the energy intake should come from TFA. SFA + TFA contributed to approximately 15 E%, compared to the recommended level of about 10 E%.

Carbohydrates

The per capita exposure to glycaemic carbohydrates, i.e. carbohydrates that are absorbed in the small intestine (starch, sugars and disaccharides), was estimated to be 328 g/day. Of these carbohydrates, 37 % (by weight) originated from cereal products and of the carbohydrate classes starch contributed the most (45 %). Using the estimated per capita energy supply of 12.5 MJ per person and day, the market baskets glycaemic carbohydrates contributed 45 E%, and the calculated amount of added sugars corresponded to approx. 15 E%. The estimated exposures were similar to those from the 2005 Market Basket. The estimated supply of added sugars in the typical Swedish diet, 15 E%, is higher than the upper limit of 10 E%, as specified in the Nordic Nutrition Recommendations (NNR) from 2004. Regarding dietary fibre, the supply from the market baskets corresponds to ca. 1.7 g per MJ, which is lower than the recommended level of 3 g per MJ according to NNR.

Vitamin D

The daily per capita exposure to vitamin D_3 was estimated to be 6.1 μg per person and day. Major sources of vitamin D_3 were fats (42 %), fish (27 %) and dairy products (19 %). Vitamin D_3 was not detected in meat products. 25-OH-vitamin D, which is usually found in animal products, was not analysed and the estimated exposure is thus underestimated. Calculations based on the ingredient list using data from NFA's food composition data base give a higher figure, 8.3 μg per person and day, which is in line with the recommended intake of 7.5 μg (NNR, 2004).

Essential mineral elements

The daily estimated per capita exposure was 3385 mg sodium (Na), 11.4 mg iron (Fe), 11.7 mg zink (Zn), 1.3 mg copper (Cu), 4.0 mg manganese (Mn), 52 μg selenium (Se), 126 μg iodine (I), 157 μg molybdenium (Mo), 38 μg chromium (Cr) and 11.3 μg cobalt (Co). Compared to the market basket study carried out in 1999, the present estimates of sodium and chromium was higher, while that of iodine was lower. The lower exposure to iodine is most probably due to a decreased iodide concentration in milk and milk products. Since household salt, which is generally iodized, was not included in the baskets, the exposure of iodine and sodium is probably underestimated. No clear trends were seen for zink, manganese, coper and selenium. Average exposure to most of the essential elements, except iron for women and iodine, was close to or above daily recommended intakes or reference values for adults set by Nordic and U.S. expert committees.

Toxic metals

Generally, there is a margin between estimated per capita exposures and internationally accepted tolerable intake levels or reference doses, and the results thus indicate that the exposure to most of the analysed toxic metals is likely to be of low concern for an average Swedish consumer. Arsenic may potentially be an exception and estimated exposures are uncertain for aluminium. For cadmium and lead the per capita exposures are not very far from health-based reference values, and in case of lead a higher per capita exposure at present compared to the 1999 market basket study could be noted. It should also be noted that tap water, coffee, tea, wine and other alcoholic beverages are not included in this study, which in some cases could have consequences for assessment of the total exposure to some metals.

Persistent organic pollutants (POPs)

The calculations of per capita intakes of polybrominated diphenylethers (PBDEs), hexabromocyclododecane (HBCD), polychlorinated biphenyls (PCBs), polychlorinated dioxins and dibenzofurans (PCDD/Fs), and chlorinated pesticides in most cases show that the average intake of these compounds from food on the Swedish market have decreased significantly between 1999 and 2010, although the decrease was most pronounced during the period 1999-2005. The per capita exposures to PCDD/Fs and dioxinlike PCBs, as well as the pesticides hexaclorobenzene (HCB) and the DDT-compound p,p´-DDE were in 2010 below established tolerable/acceptable intakes. For PBDEs and non-dioxinlike PCBs the exposures were more than 60-fold lower than the intakes causing no or limited negative health effects in test animals. Based on current knowledge the per capita exposures should not be regarded as important health concerns.

Pesticides

Analyses of pesticides, which were part of a market basket project for the first time, were performed on samples from the food groups vegetables, potatoes, fruits, cereal products and meat. Only fruits and vegetables contained detectable levels, and 10 substances were found out of about 400 pesticides that were included in the analytical method. All the estimated chronic exposures to pesticide residues were well below the respective acceptable daily intakes (ADIs) (i.e. 0.01- 2.3 % of ADI). Additionally, the low residue exposures, and the relatively few pesticides found with levels above their limit of detection (LOD), imply a small risk for cumulative or mixture toxicity effects from the different pesticides to occur. Based on the estimated mean per capita intake presented in this study, it is concluded that the pesticide residues found in the market baskets do not indicate any chronic consumer health concern for the Swedish average consumer. With regard to acute health risk, it is not possible to draw any conclusions, since there is no information about the pesticide residue levels in single fruits that certain individuals may be exposed to.

Polycyclic aromatic hydrocarbons (PAHs)

Analyses of PAHs, performed for the first time as part of the Swedish market basket project, showed that the PAH levels are low. Banked samples from Market Basket 1999 were analysed for comparison. The main food groups as sources for PAH exposure were sugar and sweets, cereal products, meat, and fats. The calculated exposure to benzo(a)pyrene (BaP) from food on the Swedish market points to a reduction during the last ten years, suggesting a reduced theoretical cancer risk. Bearing in mind possible future regulations, the sum of PAH4 (BaP, benz(a)anthracene, chrysene, benzo(b)fluoroanthene) was also studied in our food samples. PAH4 exposure was fairly well correlated to the BaP exposure, and similarly showed a decrease in exposure over the years 1999 to 2010. The reduction in exposure is mainly due to lower concentrations of PAHs in the analysed food groups. Although PAHs in food generally constitute a minor health risk, improperly performed barbequing may result in high PAH levels and for some consumers this substantial contribution to the total exposure of PAHs should be considered. However, home-barbequed food was not assessed in the present study.

General conclusions

The broad picture of this market basket study is in most cases satisfactory from a health-based point of view. The differences in levels, both regarding toxic compounds and nutrients, between standard and low price baskets, and between grocery chains (when this was studied) were small. For the analysed nutrients, the changes in per capita exposure compared to earlier market basket studies are generally small, and, with some exceptions, in line with recommended intakes or levels. Regarding potentially toxic compounds in food, the estimated per capita exposures are generally well below acceptable/tolerable intake levels or health-based reference doses, and time trends (when present) are mostly favourable, i.e. decreasing levels compared to earlier market basket studies. However, the exposure to cadmium and lead, that is not very far from established health-based reference levels, as well as a lack of decrease in lead exposure compared to the 1999 Market Basket, could be mentioned. The effects of combinations of different chemicals ("cocktail effect") cannot of course be ruled out, but levels of single potentially toxic compounds are often well below acceptable/tolerable intake levels or reference doses. Consequently their contributions to suspected combination effects are likely to be limited.

At the same time, there is presently a discussion about low dose effects of contaminants, often based on epidemiological or experimental studies using sensitive toxicological/ biochemical endpoints or test methods differing from the OECD guideline test protocol. Among the compounds that are analysed in this market basket study, several are known or suspected to have the potential to cause hormonal disrupting effects. These effects are often not included in standardised tests, and may therefore not be evaluated from a health risk perspective, and combination effects of these compounds are even less studied.

This assessment does not account for variability in exposure between individuals. Exposures that impose health risk concerns may potentially be present for parts of the population (e.g. for high consumers of certain foods, and children), and this aspect can be of relevance for most of the toxic compounds analysed. Other limitations to consider in this market basket study are that food items consumed more seldom or in small amounts, are not included. Also, the fact that the the food samples originated directly from the retail sector means that potential effects of food preparation and packaging at restaurants, catering and fast-food outlets on levels of analysed substances will not be found in our study. Moreover, the influence of food preparation such as cooking was not taken into account, since the samples were in most cases analysed as fresh. Some beverages that potentially could be of interest as contaminant sources, as well as sources of carbohydrates and energy, are not included in this study (i.e. tap water, coffee, tea, alcoholic beverages).

The presented Market Basket 2010 study is a relatively easy and inexpensive method for assessing per capita exposure data for a broad range of food components. Additionally, the market basket approach gives information about the contribution of different food groups to the average dietary exposure of food components in the general population. Market basket studies can also be used in the assessment of temporal trends of average exposures of food components. Banked market basket samples from 1999, 2005 and 2010 will in the future make it possible to determine average exposures of currently unknown food components that could have the potential to be beneficial or deleterious to health.

The above-mentioned limitations stress that the produced data should be used carefully, and with reference to the method used. Future improvements could be the introduction of consumption distribution in the market basket data set so that variability in consumption is accounted for. Also, the influence of cooking should be included in the future, as well as designed studies of food from catering, restaurants and fast-food restaurants. This would improve the possibility to draw more firm conclusions from the results, both in benefit and risk assessment.

2. Sammanfattning

Matkorgen 2010 presenterar nya data i Livsmedelsverkets serie av undersökningar av innehållet i en typisk svensk "matkorg". Innehållet i matkorgen speglar konsumenternas val av livsmedel. Syftet med undersökningen är att få kunskap om hur mycket av såväl näringsämnen som potentiellt skadliga ämnen vanliga livsmedel på den svenska marknaden innehåller, men även att kunna se förändringar över tid. Tidigare matkorgsundersökningar gjordes 1987 och 1994, båda med fokus på radioaktivt cesium, samt 2005 och 1999.

Innehållet i matkorgarna utgår från Jordbruksverkets data för per capita-konsumtion i Sverige, det vill säga de totala leveranserna av livsmedel till enskilda hushåll och storhushåll, delat med antalet invånare i landet. Detta ger en teoretisk genomsnitts-konsumtion för medelsvensken. Denna medelkonsumtion har kombinerats med haltdata av både näringsämnen och skadliga ämnen som uppmätts i de livsmedelsgrupper (totalt 12 stycken) som ingår i de inhandlade matkorgarna, och vi får då fram genomsnitts(per capita)-intag för de undersökta ämnena. Genomsnittsintaget är en teoretisk beräkning som till exempel inte tar hänsyn till det livsmedelssvinn som sker i hemmet.

Resultaten i översikt

I Matkorgen 2010 har två olika matkorgar undersökts - en normalpriskorg och en lågpriskorg. Med utgångspunkt från de analyserade substanserna syns maten på det stora hela vara tillfredsställande ur ett hälsoperspektiv. Skillnaderna mellan normalpriskorgen och lågpriskorgen är små, både när det gäller näringsinnehåll, förekomst av bekämpningsmedelsrester och innehåll av olika skadliga ämnen.

Skillnaderna i näringsinnehåll jämfört med matkorgsundersökningarna från 1999 och 2005 är små, och i stort sett innehåller maten tillräckligt av de näringsämnen vi behöver. För de flesta mineraler ligger halterna nära eller över det rekommenderade dagliga intaget. Undantaget är järn, som är lägre än rekommenderat för kvinnor. Innehållet av jod är något lägre än rekommenderat, medan innehållet av salt (natrium) ligger över önskvärd nivå. Innehållet av både jod och natrium är underskattat då hushållssalt, som oftast är joderat, och kryddblandningar inte ingår i undersökningen. Däremot visar statistiken att tillgången på mat är betydligt större än vad som behövs för att täcka vårt beräknade energibehov.

Bekämpningsmedel ser inte ut att vara något egentligt problem för den svenska genom-snittskonsumenten. Av 400 analyserade bekämpningsmedel hittades endast rester från tio stycken, och i dessa fall var halterna låga och exponeringen var långt under det acceptabla dagliga intaget.

Även när det gäller potentiellt skadliga metaller, som aluminium, arsenik, bly, kadmium och kvicksilver, är halterna i de flesta fall låga och bedöms i de flesta fall inte innebära någon fara för hälsan. Halterna av så kallade persistenta organiska miljöföroreningar, bland annat bromerade flamskyddsmedel, dioxiner och PCB:er, har sjunkit signifikant sedan 1999. För en genomsnittsvensk innebär det att intaget är under gränserna för de halter som bedöms vara säkra, men marginalerna är i flera fall relativt små.

Eftersom resultaten beskriver en genomsnittskonsumtion kan det inte uteslutas att enskilda konsumenter får i sig både för litet eller för mycket av något näringsämne, eller för mycket av något skadligt ämne. Det gäller särskilt personer som äter väldigt ensidigt eller är storkonsumenter av något enskilt livsmedel. Det går alltså inte att, utifrån denna undersökning, utläsa om något enstaka livsmedel innehåller höga halter av ett hälso-skadligt ämne, till exempel bekämpningsmedel, under en begränsad tid. Detta skulle i så fall kunna innebära ökade hälsorisker på kort sikt.

Näringsämnen

Fett. Totalt innehåller maten i korgarna fett motsvarande ett dagligt intag av 116 gram fett. Det är mer än Matkorgen 2005, då fettinnehållet var 108 gram. Ökningen beror främst på ett större bidrag från sötsaker, framför allt choklad och glass. De största fettkällorna är matfett (23 %), kött (21 %) och mjölkprodukter (19 %). Bakverk och sötsaker står tillsammans för nästan en fjärdedel av fettet i matkorgen (24 %).

Fettet bidrar med ungefär 34 procent av det totala energibidraget i matkorgen, vilket är inom ramen för vad som rekommenderas i de nordiska näringsrekommendationerna (25-35 energiprocent). Maten innehåller något mindre fleromättat fett än rekommen-derat, 4,4 procent av energin (5-10 energiprocent), men mer mättat fett, 14 procent av energiintaget (cirka10 energiprocent). Enkelomättat fett bidrar med 12 procent av energin, vilket är i nivå med rekommendationen (10-15 energiprocent). De största källorna till fleromättat fett är matfetter (35 %) och fisk (26 %). De största källorna till mättat fett är mejeriprodukter (28 %), kött (22 %) och matfetter (20 %).

Innehållet av transfett motsvarar ett dagligt intag av 1,7 gram per person, eller 0,5 procent av energin. Den främsta källan är naturligt transfett från kött och mjölkpro-dukter medan innehållet av industriellt framställt transfett är lågt. FAO/WHO rekom-menderar att högst 1 procent av energiintaget kommer från transfetter. Svenskarnas genomsnittsintag av transfett ligger därmed betryggande under denna rekommendation. Innehållet av transfett är något lägre än i Matkorgen 2005.

Kolhydrater. Korgarna innehåller kolhydrater i form av stärkelse och sockerarter motsvarande ett innehåll av 328 gram samt 21 gram kostfiber per person och dag, vilket motsvarar ungefär 46 procent av det totala energiintaget. Liknande siffror sågs i Mat-korgen 2005. 37 procent av kolhydraterna (i vikt) kommer från spannmålsprodukter och så mycket som 19 procent från socker och godis. Ungefär 15 procent av energiintaget beräknas komma från tillsatt socker, vilket är 50 procent mer än vad som rekommen-deras som högsta intag i de nordiska näringsrekommendationerna. Däremot innehåller korgarna endast 60 procent av den mängd fibrer som rekommenderas och innehållet är lägre jämfört med Matkorgen 2005 (21 gram jämfört med 24,8 gram).

Vitaminer och mineraler. Totalt innehåller korgarna D-vitamin motsvarande ett intag på 6,1 mikrogram per person. Nästan hälften (42 %) kommer från matfetter, drygt en fjärdedel (27 %) från fisk och en femtedel (19 %) från berikade mjölkprodukter. Innehållet av D-vitamin är något lägre än det rekommenderade intaget på 7,5 mikrogram/dag. Mängden D-vitamin är dock underskattad eftersom en typ av D-vitamin inte har analyserats (25-hydroxy-vitamin D, som finns i animaliska livsmedel).

Förutom D-vitamin analyserades livsnödvändiga mineraler, bland annat järn, zink, koppar, mangan, selen, jod och natrium. För de flesta ämnena ligger halterna nära eller över det rekommenderade dagliga intaget. Undantaget är intaget av järn, som är lägre än rekommenderat för kvinnor, och jod. Innehållet av jod är lägre än i Matkorgen 1999. Detta beror troligen på lägre halter jod i mejeriprodukter. Intaget av jod är dock underskattat eftersom en del av det jod vi får i oss kommer från joderat hushållssalt, vilket inte ingick i analysen och intagsberäkningarna.

Innehållet av natrium, som framför allt finns i koksalt, har ökat jämfört med Matkorgen 1999. Detta är anmärkningsvärt med tanke på att Livsmedelsverket sedan flera år för en dialog med livsmedelsindustrin om att sänka saltinnehållet i maten.

Skadliga metaller

Sju skadliga metaller analyserades: aluminium, arsenik, bly, kadmium, kvicksilver, nickel och silver. Resultaten visar att halterna generellt är låga. För de flesta metaller innebär denna exponering inte någon risk för hälsan för en vuxen genomsnittskonsument. Intaget av kadmium, 1,3 mikrogram per kilo kroppsvikt och vecka, ligger under men dock inte så långt ifrån den gräns som EU:s myndighet för livsmedelssäkerhet (EFSA) bedömer är ett tolerabelt veckointag (2,5 mikrogram per kilo kroppsvikt). Även intaget av arsenik (2,4 mikrogram per kilo kroppsvikt och dag) ligger nära gränsen för vad som bedöms kunna ge skadliga hälsoeffekter. Här är dock bedömningen osäker pga förekomst av olika kemiska arsenikformer, av vilka endast vissa har negativ effekt på hälsan. Medelintaget av bly har ökat jämfört med 1999 års matkorgsundersökning, men sjunkit sedan en studie utförd 1987. Intaget av bly är under den nivå som EFSA har bedömt som acceptabel, men marginalen är relativt liten.

Organiska miljöföroreningar

Förekomsten av organiska miljöföroreningar i livsmedel, bland annat bromerade flamskyddsmedel, dioxiner och PCB:er, har sjunkit signifikant sedan 1999. Den största minskningen sågs mellan 1999 och 2005, sedan dess tycks minskningen ha bromsats upp. Intaget av dioxiner och dioxinlika PCB:er ligger ungfär tre gånger under de värden som har bedömts som acceptabla ur hälsosynpunkt. För polybromerade difenyletrar PBDE och icke-dioxinlika PCB:er ligger intaget minst 60 gånger under de nivåer som anses öka risken för negativa hälsoeffekter.

Bekämpningsmedel

För första gången ingick bekämpningsmedelsrester i matkorgsundersökningen. Totalt analyserades cirka 400 bekämpningsmedel i grönsaker, potatis, frukt, spannmålsprodukter och kött. Av de 400 substanserna hittades endast tio i mätbara nivåer, samtliga i frukt eller grönsaker. I övriga livsmedelsgrupper hittades inga bekämpningsmedelsrester. Detta innebär att genomsnittskonsumentens långsiktiga intag av bekämpningsmedel ligger långt under de nivåer som anses kunna innebära någon risk för hälsan. Risken för kombinationseffekter bedöms också vara liten eftersom så få bekämpningsmedel hittades, och de som hittades var i låga halter.

PAHer

Analyser av PAHer, polycykliska aromatiska kolväten, ingick för första gången i Matkorgen 2010. PAHer är ämnen som i första hand bildas vid grillning och rökning av livsmedel. För att kunna se förändring över tid analyserades även sparade prover från 1999 års undersökning. Resultatet visar att halterna av PAHer har sjunkit kraftigt sedan 1999. Halterna är nu låga och bedöms inte utgöra någon risk för hälsan. Eftersom PAHer bildas vid bland annat grillning kan dock personer som äter mycket grillad mat få ett betydande tillskott av PAHer, utöver innehållet i de undersökta matkorgarna.

För- och nackdelar med den använda metoden

Resultaten i denna undersökning tyder generellt på ett överlag tillfredsställande läge utifrån ett hälsoperspektiv. Halterna av de flesta skadliga ämnen var låga. Samtidigt förekommer en diskussion bland riskbedömare om hälsoeffekter av låga doser av kemikalier som kan finnas i bland annat livsmedel, men som det idag finns för lite kunskap om.

När resultaten från Livsmedelsverkets matkorgsundersökningar tolkas är det viktigt att vara medveten om hur data i undersökningarna har tagits fram. Matkorgsdata visar livsmedelskonsumtionen för en tänkt genomsnittsperson i Sverige, och utifrån dessa data har en genomsnittsexponering för olika ämnen i maten beräknats. Skillnader i exponering mellan låg- och högkonsumenter, eller mellan barn och vuxna, kan alltså inte följas med denna metod. Det går inte heller att säga något om ämnen som vi får i oss genom konsumtion av ”sällan-livsmedel”, då dessa inte ingår i matkorgen. Den faktiska konsumtionen är också lägre än den som erhålls från matkorgsdata p.g.a. svinn i hushålls- och detaljistleden.Vissa drycker är också uteslutna från Matkorgen 2010: kaffe, te, kranvatten och alkoholhaltiga drycker. Trots sina begränsningar är matkorgsmetoden ett relativt enkelt och förhållandevis billigt sätt att få en uppfattning om medelexponeringen av en mängd olika ämnen i livsmedel i en och samma studie, ett bra sätt att följa tidstrender av ämnen i livsmedel, samt ger en möjlighet att analysera lagrade matkorgsprover för nya ämnen vid senare tillfälle.

3. List of abbreviations

ADI/TDI	Acceptabel/Tolerable daily intake
AOCS	American Oil Chemist Society
BaP	Benzo(a)pyrene
BMDL	Benchmark dose, lower confidence limit
SBR	Schmid-Bondzynski-Ratzlaff
CONTAM	Contamination expert panel at EFSA
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DHA	Docosahexanoic acid
EFSA	European Food Safety Agency
EPA (1)	Environment Protection Agency
EPA (2)	Eicosapentanoic acid
FA	Fatty acid
GC	Gas chromatography
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCH	hexachlorocyclohexane
HPLC	High-performance liquid chromatography
IPCS	International Programme on Chemical Safety
JECFA	Joint Expert Committee on Food Additives
JMPR	Joint Meeting on Pesticide Residues
LB	Lower bound
LOD	Limit of detection
LOQ	Limit of quantification
MB	Medium bound
MUFA	Monounsaturated fatty acid
NFA	National Food Agency
NNR	Nordic nutritional recommendations (Nordiska näringsrekommendationer)
PAHs	Polycyclic aromatic hydrocarbons
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
PCDD/DFs	Polychlorinated dibenzo-p-dioxins and dibenzofurans
POPs	Persistent organic pollutants
PUFA	Polyunsaturated fatty acid
SCF	Scientific Committee for Food
SFA	Saturated fatty acid
TDS	Total diet study
USEPA	United States Environment Protection Agency

4. Background

Market basket surveys are performed with the purpose of obtaining information on levels of nutrients and potentially harmful components in commonly consumed products or product groups on the food market. By use of per capita food consumtion data, derived either from producers and trade statistics or from dietary surveys, defined market/food baskets are collected and the mean exposure to analysed components in food/food groups can easily be estimated. The advantage of the market basket approach is the relatively simple and inexpensive method for obtaining information on levels in food/food groups and estimated mean exposure to a certain component. Moreover, the market basket approach gives information about the contribution of different food groups to the average exposure. If the studies are carried out regularly (in Sweden every 5 years) the results can be used to study temporal trends of average exposure to studied contaminants/nutrients. At the same time, it should be kept in mind that the obtained estimates include a number of approximations and uncertainties.

In Sweden market basket studies using similar methods as in the present study were performed in 1999 and 2005. Market basket studies had been carried out also earlier, and studies were conducted in 1987 and 1994, with the main goal to assess the exposure to radioactive cesium (Ohlander et al., 1991; Möre et al., 1995). However, other metals were also assessed in the 1987 study (Becker and Kumpulainen, 1991). In the Swedish market basket study from 1999, reports were published on the levels and estimated exposures to persistent organic pollutants (POPs) (Darnerud et al., 2006) and metals (Becker et al., 2011), and data from the 2005 Market Basket study include POPs (Törnkvist et al., 2011), fats and fatty acids (Becker et al., 2008) and starch, sugars and dietary fibre (Becker et al., 2009) (the latter two reports in Swedish).

The market basket approach has been widely used, for a number of specific purposes. At the same time, the definition of the term Market Basket is very broad and has globally been used to define studies which are very different in nature (e.g. Wang et al., 2011; Meena et al., 2010; Williams et al., 2007). Another term used to define a similar type of study is Total Diet Study (TDS). TDS reports from France and Ireland have recently been published (ANSES, 2011; FSAI, 2011), and in addition the European Food Safety Authority (EFSA) has produced a guidance document on TDS aiming at a harmonisation of these methods (EFSA, 2011a). In a continuation of this approach, the EC has given approval for a common European developmental project around these questions within the Seventh Framework Programme, named TDS Exposure. This project started in 2012 with Sweden as one of the participating countries. Hopefully, this project will give us new insights and improve our methods in future market basket/total diet studies.

5. Aims

The aims of the present market basket study are a) to produce up-to-date concentration data of nutrients and various other components in food groups of relevance for Swedish consumers, b) to estimate the theoretical mean per capita exposure of the analysed compounds in food, based on sales figures, and c) to investigate temporal changes of per capita exposure data including the results from 1999 and 2005.

6. Selection of food items

The Swedish Board of Agriculture (SBA) produces yearly reports of per capita consumption data based on production and trade statistics, giving information on annual market availability of food categories and foodstuffs (e.g. SBA, 2010). In many cases, the food categories could be further divided into specific items based on allocation figures, i.e. the relative (percentual) allocation within certain food categories, for instance soft bread divided into white, rye and mixed flour bread. These allocation factors are updated by the SBA, by use of data on their respective market shares. In some cases, certain food groups have over time gradually been added together into one single category with one consumption figure only, e.g soft drinks and juice are now combined. Since the year 2000, SBA does not give detailed reports of fresh fish consumption and tap water used for drinking is not given in the statistics.

The purchased food baskets contains specific food items or categories that have a mean consumption of at least 0.5 kg per person and year (corresponding to approx. 1.5 g/day). This means that ca 90 % of the direct consumption is covered by these market baskets, when expressed in kg per person. Alcoholic beverages (strong beer, wine, spririt), household salt, coffee and tea (dry, instant) were not included. A purchase list of specific food items/categories is produced and guided by this list the responsible purchasing person chooses one or several food items to be purchased/sampled, depending on the specificity of the statistics (cf. allocation within food categories, above). Each market basket thus contains more than 130 food items (Annex A).

In the present market basket study SBA statistics from 2007 were used (SBA, 2010). Supplementary purchase statistics for fish and fats (for 2009/2010) have been obtained from the market research company Growth from Knowledge (GfK), Sweden. This is due to the lack of detailed data on fresh fish and on fats in the SBA report. The GfK statistics are based on their consumer panels and can be transformed into figures on the total consumption volume (in kg) and on some of the leading products and specific types or products of fish.

The food items/categories in the purchased market baskets have been divided into 12 food groups, based on an ordinary sorting of food products commonly found on Swedish market (Table 6:1). Based on these, the contribution of the different food groups to the total exposure of nutrients and food contaminants could be estimated.

Table 6:1. Food groups used for sorting food items purchased in the Market Basket project, and weights of respective food homogenates (repr. 1 % of annual per capita consumption, after removal of inedible parts).

Group No.	**Food group**	**Description of food items/categories**	**Weight of food group homogenate (g)**
1	Cereal products	Flour, grain, corn flakes, pasta, bread	844
2	Pastries	Biscuits, buns, cakes, pizza	185
3	Meat	Incl. meat products; beef, pork, lamb, game, poultry, cured/processed meats	759
4	Fish	Incl. fish products; fresh and frozen, canned, shellfish	185
5	Dairy products	Milk, sour milk, yoghurt, cream, hard cheese, processed cheese, cottage cheese	1557
6	Eggs	Fresh eggs	84
7	Fats	Butter, margarine, cooking oil, mayonnaise	145
8	Vegetables	Incl. root vegetables, fresh and frozen, canned products	704
9	Fruits	Fresh and frozen, canned products, juice, nuts, cordials, jam	867
10	Potatoes	Fresh, French fries, potato crisps, potato purée (ready-made)	458
11	Sugar and sweets	Sugar, honey, chocolate, sugar sweets, mustard, ketchup, dairy and vegetable fat-based ice-cream, ready-made sauces and dressings	453
12	Beverages	Soft drinks, mineral water, beer (up to 3.5 vol. % alcohol)	1205

7. Collection of food samples

In the two earlier Swedish Market Basket projects in 1999 and 2005, the food baskets were obtained from four larger Swedish cities (Malmö, Gothenburg, Uppsala, Sundsvall), representing different regions and major populations areas (Darnerud et al., 2006; Becker et al., 2011; Törnkvist et al., 2011). However, an evaluation of the results from these surveys showed in most cases no significant and consistent difference between food baskets from these cities, and it was therefore decided to collect the food baskets from just one city, namely Uppsala. The Uppsala baskets were collected from five different major grocery chains (Coop, ICA, Willys, Hemköp, and Lidl). The purchases were all made in May-June 2010, plus a supplementary purchase of fruit, vegetables, and potatoes in the autumn of the same year (September-October) with the purpose of obtaining more Swedish-grown products. Due to delay in obtaining consumption data on fish, sampling of this food group was postponed and synchronised with the vegetables (September-October).

One objective of the food sampling in this project was to look for possible differences between standard-price and low-price products. Based on this approach two food baskets were collected at each food chain, one standard and one low price basket. For one of the food chains (Lidl) only one basket was collected because of a limited selection of food items within each food group. To conclude, nine different food baskets were collected from these Uppsala food stores during spring 2010, and five supplementary purchases of vegetables, fruits and potatoes (of what was defined as being in the standard price category) were made from these food chains were done in autumn the same year.

8. Sorting and preparation of samples for analysis

In the present Market Basket study, the food items/categories within each basket were divided into twelve different food groups (See Table 6:1). Within each group a homogenate was produced containing specific amounts of different food items in relation to their purchase volumes. Thus, from each food item/category, a defined quotient (normally one percent by weight) of the yearly per capita consumption, as estimated by SBA, was taken out for homogenate preparation. In case of food items where wastage is obvious, inedible parts such as bone, skin, peel etc. were removed prior to weighing, but apart from that no other possible food wastage was compensated for. It should also be noted that no further preparation of the food (cooking, frying etc) was done before producing the homogenate. The weighed amounts of food samples within a group were subsequently mixed and carefully blended, and the homogenate was used in chemical analyses. From each homogenate, a certain amount was banked for possible future analytical purposes. Future needs for samples from the Market Basket project will be subject to priority judgements.

The number of homogenates, and consequently the number of samples that maximally could be used for chemical analysis, are given in Table 8:1. As shown, 108 homogenates were produced from the food baskets purchased from the five grocery chains, and additionally 15 homogenates were made from the purchase of vegetables, fruits and potatoes in the autumn.

Table 8:1. Number of homogenate samples of different food groups available for chemical analyses in Market Basket 2010, altogether 123 samples.

Grocery chain	Standard-price basket	Low-price basket	Autumn sampling of vegetables, fruits, potato
COOP	12	12	3
ICA	12	12	3
Hemköp	12	12	3
Willys	12	12	3
Lidl	12	-	3
Total	*60*	*48*	*15*

9. Selection of analytes

In the choice of analytes we assessed which compounds are of major importance from a health or risk perspective, what analytes are relevant to study from a chemical and financial perspective, and which analytes have been measured in earlier market basket studies (from a time trend perspective). In the present market basket study, we analysed pesticides and PAHs for the first time, whereas nutrients, metals and POPs have been studied earlier. In Table 9:1, the number of samples analysed for different analytes are specified.

Perfluorinated alkyl acids (PFAAs) in selected Market Basket 2010 samples have been analysed outside this project (Vestergren, 2011), and brominated dioxins and chlorinated naphthalenes will be analysed at a later time point.

Table 9:1. Number of samples analysed for different analytes, with specifications

Analyte	**No. of analysed samples**[1]	**No. of anal. compounds per sample**	**P/I**[2]	**Std./Low price**	**Comments**
Nutrients, minerals/metals					
Total fat	22	(1)[3]	P	S + L	No beverage samples
Fatty acids	22	ca. 60	P	S + L	No beverage samples
Carbohydrates	23	6	P	S + L	One bev. sample analysed
Fibre	10	1	P	S + L	Cereals, pastries, vegetables, fruit, potatoes
Vitamin D	14	1	P	S + L	Cereals, pastries, meat, fish, dairy pr., eggs, fats
Sodium (Na)	23	1	P	S + L	One bev. sample analysed
Iodine (I)	20	1	P	S + L	No bev. and no fat samples
Mineral and metals	118	15	I	S + L	All samples except bev. samples, low price
POPs					
Chloropesticides	25	8 [4]	I	S	Meat, fish, dairy pr., eggs, fats
PBDEs and HBCD	45	11	I	S + L	- “ -
PCBs (ndl)	45	16	I	S + L	- “ -
TEQs (PCDD/F+dl-PCB)	45	17+12	I	S + L	- “ -
Other					
Pesticides	50	Approx 400	I	S+L	Vegetables, potatoes, fruits, cereals, meat
PAHs	11	25	P	S+L	Fats, vegetables, fruits, potatoes, sugar and sweets, and (only std. price) beverages

1) Total number of available samples = 123
2) Pooled /Individual baskets as regards grocery chains
3) Gravimetric determination
4) 12 analysed compounds in fish samples (chlordanes added)

10. Per capita body weight calculations

A mean body weight for all consumers was calculated, using a simple calculation based on weight-curves and statistical data on the number of Swedish children and adolescents in each age class, and for adults (age 18 and above) the mean body weight from the presently ongoing consumption survey Riksmaten 2010-2011 (NFA, 2012). The resulting mean weight for the whole population was estimated to 67.2 kg, and the estimated weight for girls/women was 62.3 kg and for boys/men 73.4 kg (calculations in Annex B).

11. Definition of per capita consumption and exposure

In this report, the terms per capita consumption (of food) and per capita exposure (to compounds, both nutritious and potentially harmful, found in food) are both based on the SBA data on production and trade statistics. Thus, the first term represents the theoretical mean consumption, i.e. availability, derived from Swedish sales statistics by dividing the total sales volume (of a food item/category) by the number of inhabitants in Sweden, and the second term is based on the first one by multiplicating the per capita consumption figure by the level of the actual compound found in the food homogenate.

In this study we present approximate estimates of a Swedish average consumer's exposure over time. The market basket approach used in these estimations is an indirect method of monitoring consumption, as we rely on figures of food purchased in shops and not on information of the consumers own food consumption. Because of this, we have for instance no data on food losses, but we know that all food is not eaten. However, all types of population-based assessments of food consumption are suffering from errors or limitations of some kind, which may result in both under- and over-estimations of the "real" consumption. Nevertheless, regarding assessment of dioxin exposure for the Swedish population, earlier data from the NFA show a good correspondence between the mean exposure estimated in a population-based dietary survey, and by market basket results of 1999 (Darnerud et al., 2006).

12. Chemical analysis

12.1 Nutrients and vitamins

12.1.1 Selection and pooling of samples

For some components, individual homogenates of baskets from each store and food group were merged prior to analysis, resulting in one sample per food group and normal-price and low-price basket, respectively. This applies to total fat and fatty acids, carbohydrates, vitamin D, sodium and iodine.

12.1.2 Chemical analysis – general comments

Total fat, individual fatty acids, mono- and disaccharides, starch, dietary fibre, vitamin D, sodium and iodine were analysed in this market basket study. All nutrients were also analysed in previous food market basket study in 2005 except vitamin D which was included for the first time. The analysis of fatty acids, vitamin D, mono- and disaccharides and starch were performed at the National Food Agency, NFA in Uppsala. The National Veterinary Institute in Uppsala carried out analysis of fat on meat, fish, dairy products, eggs, fats and sugar and sweets and analysis of sodium and iodine. Analysis of fat in cereal products, pastries, vegetables, fruits and potatoes and analysis of dietary fibre was carried out at Eurofins Sweden AB in Lidköping.

12.1.3 Fat and fatty acids

Total fat was analysed in March 2011 in all food groups except beverages (i.e. 22 samples; see Table 9:1) with accredited gravimetric standard methods. Fat in dairy products, fats and sugar and sweets was analysed with the Röse-Gottlieb method according to NMKL, the Nordic Committee on Food Analysis (NMKL 10) and fat in cereal products, pastries, meat, fish, eggs, vegetables, fruits and potatoes with the SBR method according to NMKL (NMKL 131).

Fatty acids were analysed in August 2011 in all food groups except beverages with an in-house validated and accredited method. Fat was extracted according to Folch (Folch et al., 1957). The fatty acids in the fat were transferred to methyl esters and separated on a capillary column. Reference standards containing individual saturated, monounsaturated and polyunsaturated fatty acids were used for identification (IUPAC, 1979a,b). Trans fatty acids were analysed according to an AOCS standard method (AOCS Official method Ce 1f-96) using a GC with 100 m HP-88 capillary column for separation. The limit of detection (LOD) is 0.03 % for each fatty acid.

The concentrations of total fat in the food groups are given in Table 12.1:1. Concentrations of individual trans fatty acids are given in Annex C. Concentrations of individual fatty acids are given in Annex D. The differences between the standard- and low-price baskets were generally small.

The concentration of fat was highest in the food groups fat (67 g/100 g) and pastries (20 g/100 g).

The proportion of saturated fatty acids (SFA) was highest in the dairy products (65 %), sugar and sweets (50 %), pastries (48 %) and meat (41 %). Trans fatty acid concentrations were generally below 1 % of total fatty acids, with the exception of dairy products (4 %), meat (1.5 %) and fats (1.2 %). The proportion of monounsaturated fatty acids (MUFA) was 78 % in fruits, 60 % in potatoes and 40-50 % in meat, fish, fats and eggs. The proportion of polyunsaturated fatty acids (PUFA) was 56 % in vegetables, 42 % in cereal products and 33 % in fish. The proportion of n-3 fatty acids was highest in fish (18 %), followed by vegetables (12 %) and fats (5 %), while the proportion of n-6 fatty acids (mainly linoleic acid) varied from 2 % in dairy products to 36-44 % in cereal products and vegetables.

Table 12.1:1. Concentrations of nutrients in the twelve food groups sampled in 2010.

Sample	**Food Market Basket 2010**	**Fat** g/100g	**Sodium*** mg/100g	**Iodine** µg/100g	**VitaminD_3** µg/100g
s-p	**Cereal products**	2.2	299	3.6	0.11
l-p	**Cereal products**	2.2	287	6.0	<0.1
s-p	**Pastries**	19.6	258	4.2	0.55
l-p	**Pastries**	20.4	286	4.4	0.86
s-p	**Meat**	11.8	503	5.8	<0.1
l-p	**Meat**	12.0	476	5.3	<0.1
s-p	**Fish**	10.9	684	70,0	3.27
l-p	**Fish**	12.1	647	57,0	3.65
s-p	**Dairy products**	5.0*	87.5	8.3	0.28
l-p	**Dairy products**	5.1*	110	8.2	0.26
s-p	**Eggs**	9.5	132	36.0	0.83
l-p	**Eggs**	9.4	126	32.0	0.99
s-p	**Fats**	67.2*	424	n.a.	6.45
l-p	**Fats**	66.1*	460	n.a.	5.22
s-p	**Vegetables**	0.2	64.7	1.7	n.a.
l-p	**Vegetables**	0.2	51.3	1.3	n.a.
s-p	**Fruits**	1.2	4.21	0.9	n.a.
l-p	**Fruits**	0.9	4.56	0.8	n.a.
s-p	**Potatoes**	1.7	35.8	1.2	n.a.
l-p	**Potatoes**	2.1	34.3	0.8	n.a.
s-p	**Sugar and sweets**	11.5*	286	23.0	n.a.
l-p	**Sugar and sweets**	12.1*	215	8.5	n.a.
s-p	**Beverages**	n.a.	3.7	n.a.	n.a.

s-p= standard-price　　n.a. = not analysed
l-p = low-price　　* no accredited analysis

Of the about 60 fatty acids that is included in the standard assay a few were not detected (15:1, 16:0 ai, 18:0 ai, 22:2 n-6, 22:4 n-3, 22:5 n-6, 23:0). Positional isomers of unsaturated acids were not further specified.

12.1.4 Carbohydrates

Sugars (glucose, fructose, sucrose, maltose, lactose) and starch were analysed in all food groups except eggs and fats. Sugars were analysed with a gas chromatographic method described elsewhere (Fuchs et al., 1974). Starch was analysed with an enzymatic standard method according to NMKL (NMKL 145). The methods for both sugars and starch were accredited for all food groups except fish at the time of analysing. Validation for fish was done during the survey and accreditation for fish was received afterwards. Both methods have a limit of detection (LOD) of 0.03 g/100 g.

Dietary fibre was analysed in cereal products, pastries, vegetables, fruits and potatoes with an accredited enzymatic, gravimetric standard method according to NMKL (NMKL 129).

The concentrations of carbohydrate constituents in the food groups are given in Table 12.1:2. The differences between the standard- and low-price baskets were generally small. All samples were analysed during spring 2011.

Table 12.1:2. Concentrations of carbohydrates in the twelve food groups sampled in 2010.

Sample	Food Market Basket 2010	Fructose g/100g	Glucose g/100g	Sucrose g/100 g	Maltose g/100g	Lactose g/100g	Starch g/100g	Fibre g/100 g
s-p	**Cereal product**	1.36	1.16	0.36	2.09	0.21	45.8	3.1
l-p	**Cereal products**	1.24	1.12	0.29	1.96	0.21	47.7	5,0
s-p	**Pastries**	1.02	1.48	23.1	0.83	<0.03	23.9	2.7
l-p	**Pastries**	1.08	1.25	20.2	0.69	<0.03	26.1	2.3
s-p	**Meat**	0.06	0.57	0.16	0.42	0.16	1.58	n.a.
l-p	**Meat**	0.05	0.64	0.21	0.28	0.03	1.03	n.a.
s-p	**Fish**	0.05*	0.14*	2.09*	0.22*	0.08*	1.63*	n.a.
l-p	**Fish**	0.04*	0.17*	1.92*	0.29*	0.06*	1.48*	n.a.
s-p	**Dairy products**	<0.03	0.12	0.38	<0.03	3.25	<0.03	n.a.
l-p	**Dairy products**	<0.03	0.14	0.41	<0.03	3.81	<0.03	n.a.
s-p	**Eggs**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
l-p	**Eggs**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s-p	**Fats**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
l-p	**Fats**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s-p	**Vegetables**	2.26	1.85	<0.03	0.12	<0.03	0.33	2.1
l-p	**Vegetables**	1.96	1.79	<0.03	0.10	<0.03	0.51	2.2
s-p	**Fruits**	8.06	6.83	5.39	0.14	<0.03	<0.03	1.7
l-p	**Fruits**	6.76	5.80	5.06	0.22	<0.03	0.45	1.6
s-p	**Potatoes**	0.20	0.29	0.26	0.11	<0.03	15.8	1.9
l-p	**Potatoes**	0.48	0.46	0.05	0.13	<0.03	15.7	2.4
s-p	**Sugar and sweets**	2.09	3.53	38.6	1.14	2.04	3.49	n.a.
l-p	**Sugar and sweets**	1.98	4.08	37.6	1.02	2.16	2.54	n.a.
s-p	**Beverages**	1.08	0.94	4.13	<0.03	<0.03	0.32	n.a.

s-p= standard-price n.a.= not analysed
l-p = low-price * no accredited analysis

The starch content was highest in cereal products, followed by potatoes and pastries. Glucose and fructose concentrations were highest in fruits. The content of sucrose was highest in sugars and sweets, followed by pastries. Lactose was mainly found in dairy products followed by sugar and sweets. Maltose was mainly found in cereal products. Content of dietary fibre was highest in cereal products.

12.1.5 Vitamin D

Vitamin D_3 was analysed in May 2011 in cereal products, pastries, meat, fish, dairy products, eggs and fats. The method used is accredited and validated in an NMKL collaborative study published in Journal of AOAC International (Staffas and Nyman, 2003). Vitamin D_2 is used as internal standard. The sample is extracted with n-heptane after addition of internal standard and saponification. After evaporation the sample extract is purified with straight phase HPLC using a silica column. Quantitative determination is done by reversed phase HPLC (C-18) with UV detection. The content of vitamin D_3 is calculated with the internal standard as reference. The limit of detection is 0.1 µg/100 g, except for dairy products where the limit of detection is 0.01 µg/100 g.

The concentrations of vitamin D_3 in the food groups are given in Table 12.1:1. The differences between the standard- and low-price baskets were generally small. The vitamin D_3 content was highest in fats and fish.

12.1.6 Analytical quality control

The laboratory at NFA as well as the other two laboratories involved, have a long history of working with nutritional analyses and quality assurance. Some of the used methods have been accredited (SS-EN ISO/IEC 17025:2005) since 1995 by SWEDAC, the Swedish Board for Accreditation and Conformity Assessment. The quality of the analytical work is ensured by a quality system and external and internal audits. Analysis checks are done in form of recovery tests, blank samples and for the daily control an in-house control sample runs with each batch of samples. The trueness of the methods is proven by using certified reference materials and frequently participating in proficiency tests.

12.2 Mineral elements/metals

12.2.1 General procedure for metal analysis

The samples were prepared, homogenised and packed in glass jars at the NFA, prior to shipment to ALS Scandinavia, Luleå, Sweden, for determination of the mineral elements. Liquid samples (e.g. beer and soft drinks) were analysed as received, without digestion. Other samples were digested in a microwave oven in HNO_3 in closed teflon vessels. The determinations were made with inductively coupled high resolution mass spectrometry (ICP-HRMS), in accordance to a modified version of USEPA method 200.8 The laboratory has participated in several proficiency tests (PT) during the study period, with satisfactory results (see Table 12.2:1). Proficiency tests are not provided for every element or sample matrix, but the results indicate that the laboratory is generally competent in elemental analysis. In addition they make extensive use of certied reference materials (CRMs), as well as in-house reference materials (IRMs). The results of the RMs must comply with certain predetermined requirements in order for the batch to which it belongs to be accepted. The elements aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), *iron (Fe)*, lead (Pb),manganese (Mn), mercury (Hg), *molybdenum (Mo)*, nickel (Ni), *selen (Se), silver (Ag)*, and zinc (Zn) were analysed. The method is accredited by SWEDAC, except for the elements in *italics,* and for the matrices beverages, cereal products, pastries and fats.

All results above the LOQ (i.e. not the LOD) for elements included in the accreditation are accompanied by their expanded measurement uncertainty (U). In Table 12.2:2, U is presented for the analytical range for each of these elements.

The ALS laboratory is required to report the limit of quantification (LOQ) as the lower limit. This corresponds to approximately 10 times the standard deviation (SD) for the mean noice level at the concentration in the blanks. Analytical figures were, however, available for all results. In this report we have chosen to report the results in relation to the limit of detection (LOD), which corresponds to 3 SDs, or approximately one third of the LOQ. These results carry more information, which improves the exposure calculations at the lowest levels, but at the cost of somewhat larger measurement uncertainty. This modification is not endorsed by the ALS. The LOD may differ for a specific element between food groups. This is due to differences in sample weights and dilution factors as well as instrumental settings.

The elemental survey covered cereal products (9 samples), pastries (9), meat (9), fish (9), dairy products (9), eggs (9), fats (9), vegetables (14), fruits (13), potatoes (14) sugar and sweets (9). (During storage, one fruit sample was lost). The specific commodities included in each food group is described in Annex A.

12.2.2 Analysis of sodium and iodine

The samples for sodium and iodine were prepared as described in section 12.1.1 and analysed as described in 12.1.2.

Sodium was analysed in March 2011 in all twelve food groups with an in-house validated method accredited for feed but not for food. Samples were wet digested and determined by ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectrometry).

Iodine was analysed in March 2011 in all food groups except fats and beverages according to a spectrophotometric method described elsewhere (Novikov, 1971). The method is accredited for food.

The concentrations of sodium and iodine in the food groups are given in Table 12.1:1. The differences between the standard- and low-price baskets were generally small. The sodium content was highest in fish, meat and fats whereas the iodine content was highest in fish and eggs.

12.2.3 Analytical results

The concentrations of the analyzed elements in the food groups are given in Annex E. Large variations were, as expected, seen for the average concentrations of most essential elements between the food groups. There were generally minor differences between standard- and low-price baskets.

In Table 12.2:3 a summary of the results is presented. The difference in results *within* the groups representing standard price and low price samples was generally of the same order of magnitude as the difference *between* the groups, and therefore they are not presented separately, but as the mean and range for the whole food group. Similarly the results for the “autumn” commodities did not deviate from the distribution of results in the rest of the samples in the market baskets.

Several of the elements analysed in this market basket were not included in a previous market basket study from 1999 (Becker at al., 2011), but have, for different reasons, attracted more attention in recent years:
- Molybdenum is interesting from a nutritional point of view. It is also toxic at high concentrations.

- Silver has begun to be rather widely used as a disinfectant and antibacterial agent, and it may therefore be important to have background data for various foods for future studies.
- Mercury is mainly found in fish and some other marine products, but there is also an interest in the background levels in other types of food.
- Aluminium is allowed in food as a part of different food additives and as a food colour. It has also been identified in cases of suspected food fraud.
-Arsenic is of interest because the inorganic arsenic (in-As) in food is toxic, and there are ongoing discussions within the European Commission regarding the possibility of legislating on the level of in-As in food. It is therefore important to get an updated picture of the total content of arsenic in various foods.

After the preparation and homogenisation the food samples were packed in glass jars and covered with an aluminium foil before the lid was screwed on. The Al-foil would obviously jeopardize the Al-determinations, due to the risk of contamination. The results were nevertheless kept since it was found that the results were distinctly different between the food groups and that each food group was rather homogenous. It can however be seen in Annex E that in some samples the Al-level is distinctly higher, which could be the result of contamination. Therefore the Al-results should be viewed with some caution.

Table 12.2:1. Results from the ALS laboratories participation in proficiency tests (PT) at around the time of the analysis of mineral elements in the 2010 market baskets

Program		**Tested elements in mg/kg**							
		As (total)	**Cd**	**Cu**	**Fe**	**Hg (total)**	**Mn**	**Pb**	**Se**
IMEP -29	Conc.		0.12			0.016		1.67	
	z-score		*-1.1*			*+1.0*		*-0.9*	
IMEP-30	Conc.	9.66	24.3			2.58			
	z-score	*-1.1*	*+0.1*			*-0.9*		*0.16*	*-1.3*
IMEP 107	Conc.	0.172							
	z-score	*+1.2*							
SLV T-20	Conc.	1.91	0.006	0.154		0.04		0.022	
	z-score	*-0.1*	*-2.4*	*-1.0*		*-1.0*		*-0.8*	
SLV T-21	Conc.		0.029		81.2		5.69		
	z-score		*+0.2*		*+0.1*		*+0.4*		
SLV T-22	Conc.		0.007	0.585				0.024	0.227
	z-score		*-0.4*	*-0.1*				*-0.2*	*0.0*
SLV N-47	Conc.				150				
	z-score				*-0.5*				
GLHK-	Conc.	57.9	0.179					1.26	
IQTC	*z-score*	*-0.2*	*+0.3*					*-0.3*	

Table 12.2:2. Range of expanded measurement uncertainty (U) in relation to the range of analytical results.

Element	Analytical range in mg/kg	Range of U in mg/kg
Aluminium	0. 44 – 4.90	0.26 - 1.75
Arsenic	1.12 – 3.48	0.33 – 0.93
Cadmium	0.004 – 0.024	0.002 – 0.006
Cobalt	0.003 – 0.052	0.003 -0.013
Chromium	0.016 – 0.18	0.007- 0.047
Copper	0.42 – 2.36	0.012 – 0.45
Manganese	0.20 – 3.74	0.039 – 0.72
Nickel	0.026 – 0.49	0.013 – 0.13
Zinc	0.82 – 20.7	0.45 – 4.0

Table12.2:3

Elemental levels in mg/kg fresh weight in the different food groups of the Market Basket 2010.

Food group (n)	**Result**	**Mo**	**Ag**	**Cd**	**Hg**	**Pb**	**Al**	**Cr**	**Mn**
Cereal products (9)	mean	0.35	<0.007	0.019	<0.003	0.003	1.27	0.015	9.45
	min	0.28		0.016		0.002	0.71	<0.013	7.76
	max	0.42		0.023		0.003	2.39	0.021	11.5
Pastries (9)	mean	0.16	0.007	0.012	<0.003	0.004	4.90	0.042	5.28
	min	0.10		0.008		0.002	1.30	0.026	2.98
	max	0.29		0.014		0.011	24.3	0.063	8.50
Meat (9)	mean	0.038	<0.003	0.002	<0.002	<0.007	0.82	0.022	0.36
	min	0.033		0.001		<0.007	0.206	0.008	0.25
	max	0.041		0.002		0.023	4.33	0.048	0.43
Fish (9)	mean	0.010	0.004	0.005	0.036	<0.007	0.26	0.026	0.28
	min	0.007	<0.003	0.003	0.027		0.15	0.013	0.21
	max	0.012	0.006	0.011	0.058		0.46	0.055	0.36
Dairy products (9)	mean	0.057	0.00002	0.00003	0.0002	0.001	0.031	0.006	0.048
	min	0.042	<0.00002	0.00003	<0.0001	0.001	0.019	0.002	0.041
	max	0.079	0.00005	0.00004	0.001	0.002	0.076	0.016	0.072
Eggs (9)	mean	0.057	<0.007	<0.002	<0.003	<0.013	<0.03	<0.010	0.46
	min	0.030							0.32
	max	0.084							0.68
Fats (9)	mean	0.008	<0.007	0.006	<0.003	<0.017	0.094	0.02	0.036
	min	0.007	0.007	0.002			<0.03	<0.01	0.017
	max	0.011	0.007	0.010			0.25	0.03	0.065
Vegetables (14)	mean	0.084	<0.003	0.008	<0.002	<0.010	0.70	0.016	1.19
	min	0.055		0.004			0.36	0.011	1.00
	max	0.112		0.014			1.37	0.033	1.54
Fruits (13)	mean	0.018	<0.007	0.001	<0.003	<0.010	0.74	0.016	2.96
	min	0.010		0.001			0.54	0.008	1.83
	max	0.026		0.002			0.93	0.048	3.88
Potatoes (14)	mean	0.058	<0.007	0.017	<0.003	<0.013	0.31	<0.010	1.25
	min	0.033		0.009			0.20	<0.010	1.01
	max	0.099		0.024			1.11	0.012	1.54
Sugar and sweets (9)	mean	0.046	<0.007	0.009	<0.003	<0.013	4.13	0.12	2.61
	min	0.038		0.007			3.00	0.080	1.83
	max	0.066		0.012			4.90	0.18	3.57
Beverages (5)	mean	0.002	0.00003	0.0002	<0.0003	0.0007	0.12	0.002	0.021
	min	0.0005	0.00002	<0.0001		0.0002	0.03	0.0009	0.013
	max	0.002	0.00006	0.0010		0.0014	0.21	0.007	0.034

Sum of samples = 118

< =limit of detection; n = number of samples in each food group.

Table 12.2:3. Continued.
Elemental levels in mg/kg fresh weight in the different food groups of the Market Basket 2010.

Food group (n)	Result	Fe	Co	Ni	Cu	Zn	As	Se
Cereal products (9)	mean	15.8	0.011	0.145	1.85	12.0	<0.03	0.022
	min	12.6	0.009	0.090	1.55	10.8		0.009
	max	20.3	0.015	0.198	2.11	13.8		0.035
Pastries (9)	mean	11.8	0.020	0.25	1.55	7.43	<0.03	0.013
	min	9.27	0.013	0.15	1.24	6.21		0.004
	max	15.8	0.036	0.46	1.81	8.98		0.024
Meat (9)	mean	12.4	0.001	0.011	0.60	18.0	0.013	0.065
	min	10.8	0.001	0.007	0.55	15.7		0.052
	max	13.5	0.002	0.014	0.66	20.7		0.082
Fish (9)	mean	4.13	0.003	0.017	0.55	6.41	2.52	0.26
	min	2.97	0.003	0.010	0.50	5.01	1.12	0.22
	max	6.72	0.004	0.030	0.60	8.78	3.48	0.29
Dairy products (9)	mean	0.30	0.0003	0.004	0.090	6.22	0.001	0.018
	min	0.27	0.0002	0.002	0.071	5.32	0.0002	0.015
	max	0.38	0.0005	0.010	0.10	7.23	0.008	0.024
Eggs (9)	mean	18.0	0.001	<0.001	0.62	11.91	<0.02	0.17
	min	16.5	0.0003	<0.001	0.58	10.73		0.14
	max	19.7	0.001	0.002	0.66	13.30		0.20
Fats (9)	mean	0.35	0.0002	0.009	0.021	0.29	<0.03	0.015
	min	0.12	<0.0001	0.003	0.016	0.17		0.006
	max	0.48	0.0005	0.023	0.032	0.37		0.031
Vegetables (14)	mean	3.89	0.002	0.041	0.50	2.02	<0.02	0.008
	min	3.22	0.001	0.027	0.34	1.63		0.003
	max	5.21	0.003	0.063	0.65	2.40		0.017
Fruits (13)	mean	2.76	0.007	0.065	0.84	1.01	0.003	0.008
	min	2.24	0.004	0.029	0.61	0.82	<0.002	<0.002
	max	3.58	0.011	0.097	1.01	1.18	0.004	0.013
Potatoes (14)	mean	4.35	0.005	0.029	0.78	2.86	<0.003	0.010
	min	3.74	0.002	0.013	0.43	2.25		0.005
	max	5.22	0.010	0.054	1.23	3.63		0.019
Sugar and sweets (9)	mean	14.2	0.035	0.36	1.75	4.03	0.004	0.012
	min	12.0	0.027	0.30	1.39	3.48	<0.003	0.003
	max	23.4	0.052	0.49	2.36	4.73	0.007	0.027
Beverages (5)	mean	0.13	0.0002	0.005	0.045	0.024	0.001	0.004
	min	0.024	<0.0001	0.001	0.028	0.017	0.0004	0.002
	max	0.48	0.0005	0.016	0.065	0.041	0.001	0.006

Sum of samples = 118
< =limit of detection; n = number of samples in each food group

12.3 Persistent organic pollutants (POPs)

Persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), chlorinated pesticides (e. g. DDT, HCH, HCB, chlordanes) and brominated flame retardants (PBDEs, HBCD) are lipophilic substances that have the propensity to bioaccumulate and biomagnify in the food web. As a result of their stability in the environment, high volume production, long time use and long-range atmospheric transport they are ubiquitously spread in the environment and are found both in wildlife and humans (Bernes 1998). These chemicals have been intentionally produced in order to meet various demands in society. PCBs have been widely used in industry as e.g. heat exchange fluids, in electric transformers and as additives in paint and plastics (ATSDR 2000). DDT was widely used as an insecticide mainly in agriculture, forestry and malaria control during the 1940s-1960s. Although DDT has been banned since the end of the 1970s due to its significant toxicity to wildlife it is still employed in malaria vector control programmes in some tropical countries (WHO 2007). The main DDT metabolite, DDE, is even more stable than DDT and still one of the predominant contaminants found in humans and wildlife (Bernes 1998). Hexachlorocyclohexane (HCH) and chlordanes have been used as broad-spectrum insecticides since the 1940s, e.g. for agriculture and in gardens. The HCH isomer γ-HCH (lindane) has often been used as a substitute for DDT and in some countries as pharmaceutical treatment against lice and scabies. Hexachlorobenzene (HCB) has been used in small scale as a fungicide but it is also formed unintentionally as a contaminant in chemical and combustion processes (Bernes 1998). Polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCD) have been used worldwide as flame retardants since the 1970s and have been added to a large variety of consumer products such as furniture upholstery, textiles, plastics and electronic products (Alaee et al. 2003).

Dioxins (polychlorinated dibenzo-p-dioxins, PCDDs and polychlorinated dibenzofurans, PCDFs) have not been intentionally produced, but instead they are formed as a result of certain chemical processes at high temperature, for example, during incomplete combustion and in pulp and paper industry (EPA 2005). Dioxins have similar chemical-physical properties to PCBs and accumulate in the food chain.

The production, use and release of chlorinated pesticides and PCBs have in many cases been strongly controlled or prohibited since the 1970s. Strong measures were also taken to reduce dioxin emissions in the 1980s. In spite of all regulations, the ubiquitous use of POPs and the presence of large reservoirs make them still present in the environment. However, the levels in Sweden and other countries have decreased during the last decades (Bignert 2011). Strict bans have also been imposed on the worldwide production and use of some PBDE formulations. Technical mixtures of penta- and octabromodiphenyl ether were banned globally in 2009 and since 2008 the use of decabromodiphenyl ether (BDE-209) has been banned in electronic applications within the EU (UNEP, 2009; Renner 2004; European Court of Justice 2008). Despite these bans, the release of PBDEs from existing products that are in service or have been disposed of in landfill sites is likely to continue for many years to come.

For the general population the main pathway for exposure to POPs is through diet, especially from food of animal origin but for the flame retardants indoor air and dust are other important ways of exposure (Darnerud et al. 2006; Johnson-Restrepo and Kannan 2009; Törnkvist et al. 2011).

12.3.1 Chemical analysis – general comments

Dioxins (PCDD/F), PCBs, PBDEs, HBCD and chlorinated pesticides were analysed in selected food groups mainly contributing to POP exposure, eggs, fats/oils, fish/fish products, meat/meat products and dairy products. One sample per each food group and basket was analysed. This resulted in 45 samples for POP analysis (5 food groups x 9 baskets). Chlorinated pesticides were only measured in standard price baskets.

The analyses of PBDE, HBCD and chlorinated pesticides were performed at the National Food Agency (NFA), Sweden. PCDD/F and PCB were analysed by the National Institute for Health and Welfare (THL), Finland. The results are presented in Table 12.3:1, Table 12.3:2, Table 12.3:3 and more detailed data can be found in Annex F. The results are presented as mean values and in some cases as mean of sums of congeners. In the calculation of mean values, levels below the limit of quantification (LOQ) are extrapolated to either 0, i.e. lower bound (LB), to half the LOQ value, i.e. medium bound (MB) or to the LOQ value, i.e. upper bound (UB). In addition, in the case of PBDEs and HBCD, levels below LOQ but above the limit of detection (LOD) are used without extrapolation to estimate mean concentrations, and these results are also presented in Table 12.3:1. Levels below the LOQ are more uncertain than the ones above the validated LOQ levels but are in this case estimated to be more precise than the extrapolated levels. The non-extrapolated mean concentrations should be compared to data based on medium bound values, in order to estimate a possible overestimation error by the medium bound method. The PCDD/F and dioxin-like PCB (DL-PCB) levels are estimated as toxic equivalents (TEQ) using both the toxic equivalency factors (TEF) set by WHO in 1998 and the new reevaluated TEFs from 2005 (Van den Berg 2006). No data on BDE-138, BDE-183, o,p'-DDT and γ-HCH are presented due to levels below LOD or LOQ for all samples analysed.

The highest levels of POPs were found in fish samples. The differences in PBDE, HBCD, PCB and dioxin levels between the standard- and low-price baskets were in general small.

12.3.2 PBDEs and HBCD

PBDEs and HBCD were analysed in accordance with a method described elsewhere (Törnkvist et al. 2011), with a few modifications. Briefly, food homogenates were extracted first with a mixture of hexane/acetone and thereafter with a mixture of hexane/diethyl ether. After evaporation of the organic solvents the lipid content was determined gravimetrically. The extracts were redissolved in hexane and the lipids were removed by sulfuric acid treatment. Further clean up was done on a silica gel column. BDE-85 and ^{13}C-BDE-209 were used as internal standards. Ten PBDE congeners (BDE-28, -47, -66, -99, -100, -138, -153, -154, -183 and -209) and HBCD were measured by high resolution gas chromatography/low resolution mass spectrometry (HRGC/LRMS) in electron capture negative ion mode.

All glassware was heated or rinsed with acetone prior to use to reduce the risk of contamination. The laboratory is UV-light protected to prevent degradation of BDE-209 during work up. Suspected high levels of BDE-209 were confirmed by a second analysis due to enhanced risk of contamination for this specific congener via air/dust. Each batch of six samples was analysed together with a laboratory blank and a quality control sample to verify the accuracy of the method. Reported concentrations were corrected for levels found in the blank samples. Estimated LOQ was set to either ten times the standard deviation of the blank value, or if the analyte was not found in the blank, to the lowest concentration of the calibration standards. The LOQ depended on the analyte quantified and ranged between 2.5-5.9 pg/g fresh weight (f.w.) for PBDEs and HBCD except BDE-209 whose LOQ was 14 pg/g f.w. LOQ is lower in this study compared to the market basket study performed in 2005, where LOQ values for PBDEs and HBCD ranged between 5-50 pg/g f.w depending on the matrix and the analyte quantified. BDE-209 was not analysed in 2005. Levels below LOQ but above the LOD were used without extrapolating in per capita exposure estimations to compare calculations based on extrapolated medium bound mean levels and non-extrapolated levels

12.3.3 Dioxins and PCBs

Analysis of PCDD/Fs and PCBs were done in accordance with accredited methods at the National Institute for Health and Welfare in Kuopio, Finland (Isosaari et al. 2006). Seventeen toxic chloro-substituted PCDD/Fs, twelve dioxin-like PCBs (CB-77, -81, -105, -114, -118, -123, -126, -156, -157, -167, -169, -189) and sixteen non dioxin-like PCBs (CB-28, -52, -66, -74, -99, -101, -110, -128, -138, -141, -153, -170, -180, -183, -187, -194) were quantified by isotope dilution technique by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). LOQ for fish samples ranged between 0.02-0.3 pg/g f.w. for PCDD/F and dioxin-like PCBs and 0.4-4 pg/g f.w. for non dioxin-like PCBs depending on the analyte quantified. LOQ for the remaining matrices analysed ranged between 0.004-0.7 pg/g lipid weight (l.w.) for PCDD/F and dioxin-like PCBs and between 0.1-7 pg/g l.w. for non dioxin-like PCBs, depending on matrix and analyte.

12.3.4 Chlorinated pesticides

The analytical method used to analyse chlorinated pesticides hexachlorobenzene (HCB), hexachlorocyclohexane (α-, β-, γ-HCHs), chlordanes (oxy-, α-, γ-chlordane and trans-nonachlor) and DDT (o,p'-DDT, p,p'-DDT, p,p'-DDD and p,p'-DDE) has previously been described (Törnkvist et al. 2011).

The samples were extracted with a mixture of hexane/acetone followed by a mixture of hexane/diethyl ether. The fat content was determined gravimetrically after evaporation of the solvents. The fat was then removed from the extracts by sulfuric acid treatment and after that a further clean-up was done on a silica gel column. The substances were quantified on a gas chromatograph (Agilent Technologies 6890) equipped with dual capillary columns and dual electron capture detectors (GC/ECD). o,p'-DDD was used as internal standard for the analysis. A number of blank and control samples were analysed together with the samples to verify the accuracy and precision of the measurements. LOQ for the chlorinated pesticides were 0.013-0.13 ng/g f.w. depending on matrix and quantified substance. LOQ is higher in this study compared to the market basket study performed 2005, where LOQ values ranged between 0.005-0.06 ng/g f.w. depending on matrix and the analyte quantified. LOQ was revised after 2005.

Table 12.3:1. PBDE[1] and HBCD levels in food homogenates of selected market basket food groups, based on samples collected in five grocery chains in Uppsala, Sweden, in 2010. The market baskets were divided in standard (S) and low (L) price food items. Levels are given in pg/g fresh weight and mean values are presented as medium bound (MB), lower bound (LB), upper bound (UB) and as non-extrapolated mean (NE)[2]. N= number of samples analysed per each food group and basket.

		Fat (%)	BDE-28	BDE-47	BDE-66	BDE-99	BDE-100	BDE-153	BDE-154	BDE-209	HBCD
FISH (S)	**Mean (MB)**	**10.8**	**9.60**	**144**	**25.3**	**30.2**	**37.0**	**7.98**	**24.2**	**8.60**	**174**
N=5	Range (MB)	8.23-14.0	7.32-11.6	111-184	12.2-41.5	20.8-45.1	25.4-50.5	5.62-11.6	19.8-32.7	7.00-15.0	100-222
	Mean (LB)		9.60	144	25.3	30.2	37.0	7.98	24.2	3.00	174
	Mean (UB)		9.60	144	25.3	30.2	37.0	7.98	24.2	14.2	174
	<LOQ/all		0/5	0/5	0/5	0/5	0/5	0/5	0/5	4/5	0/5
	Mean (NE)		9.60	144	25.3	30.2	37.0	7.98	24.2	11.3	174
FISH (L)	**Mean (MB)**	**11.9**	**9.14**	**142**	**25.4**	**29.4**	**36.3**	**7.19**	**20.8**	**24.3**	**186**
N=4	Range (MB)	10.2-12.5	7.13-10.8	131-150	21.0-31.8	23.7-35.2	32.6-39.1	5.15-9.42	16.7-24.9	7.00-60.8	133-254
	Mean (LB)		9.14	142	25.4	29.4	36.3	7.19	20.8	20.8	186
	Mean (UB)		9.14	142	25.4	29.4	36.3	7.19	20.8	27.8	186
	<LOQ/all		0/4	0/4	0/4	0/4	0/4	0/4	0/4	2/4	0/4
	Mean (NE)		9.14	142	25.4	29.4	36.3	7.19	20.8	23.6	186
MEAT (S)	**Mean (MB)**	**12.1**	**1.25**	**2.70**	**1.30**	**2.95**	**1.25**	**1.25**	**1.25**	**8.48**	**3.19**
N=5	Range (MB)	10.5-13.2	1.25-1.25	2.70-2.70	1.30-1.30	2.95-2.95	1.25-1.25	1.25-1.25	1.25-1.25	7.00-14.4	2.50-5.93
	Mean (LB)		0	0	0	0	0	0	0	2.88	1.19
	Mean (UB)		2.50	5.40	2.60	5.90	2.50	2.50	2.50	14.1	5.19
	<LOQ/all		5/5	5/5	5/5	5/5	5/5	5/5	5/5	4/5	4/5
	Mean (NE)		0.176	1.89	0	2.86	0.806	0.846	0.438	8.41	3.33
MEAT (L)	**Mean (MB)**	**12.2**	**1.25**	**2.70**	**1.30**	**2.95**	**1.25**	**1.25**	**1.25**	**17.9**	**3.90**
N=4	Min-max	10.7-13.5	1.25-1.25	2.70-2.70	1.30-1.30	2.95-2.95	1.25-1.25	1.25-1.25	1.25-1.25	7.00-38.3	2.50-5.54
	Mean (LB)		0	0	0	0	0	0	0	14.4	2.65
	Mean (UB)		2.50	5.40	2.60	5.90	2.50	2.50	2.50	21.4	5.15
	<LOQ/all		4/4	4/4	4/4	4/4	4/4	4/4	4/4	2/4	2/4
	Mean (NE)		0.257	2.18	0	3.57	0.848	1.16	0.660	16.5	3.67

Cont. Table 12.3:1

		Fat (%)	BDE-28	BDE-47	BDE-66	BDE-99	BDE-100	BDE-153	BDE-154	BDE-209	HBCD
DAIRY (S)	**Mean (MB)**	**7.37**	**1.25**	**2.70**	**1.30**	**2.95**	**1.25**	**1.25**	**1.25**	**7.00**	**2.50**
N=5	Range	3.10-10.3	1.25-1.25	2.70-2.70	1.30-1.30	2.95-2.95	1.25-1.25	1.25-1.25	1.25-1.25	7.00-7.00	2.50-2.50
	Mean (LB)		0	0	0	0	0	0	0	0	0
	Mean (UB)		2.50	5.40	2.60	5.90	2.50	2.50	2.50	14.0	5.00
	<LOQ/all		5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
	Mean (NE)		0.032	1.38	0	1.69	0.450	0.222	0	1.11	0.654
DAIRY (L)	**Mean (MB)**	**6.60**	**1.25**	**2.70**	**1.30**	**2.95**	**1.25**	**1.25**	**1.25**	**7.00**	**2.50**
N=4	Range (MB)	5.63-8.01	1.25-1.25	2.70-2.70	1.30-1.30	2.95-2.95	1.25-1.25	1.25-1.25	1.25-1.25	7.00-7.00	2.50-2.50
	Mean (LB)		0	0	0	0.0	0	0	0	0	0
	Mean (UB)		2.50	5.40	2.60	5.90	2.50	2.50	2.50	14.0	5.00
	<LOQ/all		4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
	Mean (NE)		0.0450	0.840	0	1.11	0.318	0.188	0	1.04	0.105
EGGS (S)	**Mean (MB)**	**10.2**	**1.25**	**3.37**	**1.30**	**4.28**	**1.70**	**1.55**	**1.58**	**11.1**	**3.46**
N=5	Range (MB)	9.07-11.8	1.25-1.25	2.70-6.07	1.30-1.30	2.95-9.61	1.25-3.48	1.25-2.77	1.25-2.89	7.00-18.5	2.50-7.31
	Mean (LB)		0	1.21	0	1.92	0.696	0.554	0.578	6.94	1.46
	Mean (UB)		2.50	5.53	2.60	6.64	2.70	2.55	2.58	15.3	5.46
	<LOQ/all		5/5	4/5	5/5	4/5	4/5	4/5	4/5	3/5	4/5
	Mean (NE)		0.114	1.78	0	3.89	1.28	1.34	0.90	12.2	2.07
EGGS (L)	**Mean (MB)**	**10.9**	**1.25**	**2.70**	**1.30**	**2.95**	**1.25**	**1.25**	**1.25**	**15.7**	**2.50**
N=4	Range (MB)	10.4-11.6	1.25-1.25	2.70-2.70	1.30-1.30	2.95-2.95	1.25-1.25	1.25-1.25	1.25-1.25	7.00-24.8	2.50-2.50
	Mean (LB)		0	0	0	0	0	0	0	12.2	0
	Mean (UB)		2.50	5.40	2.60	5.90	2.50	2.50	2.50	19.2	5.00
	<LOQ/all		4/4	4/4	4/4	4/4	4/4	4/5	4/4	2/4	4/4
	Mean (NE)		0.145	1.15	0	4.01	0.988	1.82	0.772	16.1	1.91

Cont. Table 12.3:1

		Fat (%)	BDE-28	BDE-47	BDE-66	BDE-99	BDE-100	BDE-153	BDE-154	BDE-209	HBCD
FATS (S)	**Mean (MB)**	**68.9**	**1.25**	**7.71**	**1.30**	**14.4**	**1.54**	**3.10**	**1.25**	**107**	**23.7**
N=5	Range (MB)	66.2-72.0	1.25-1.25	6.06-10.4	1.30-1.30	11.6-16.1	1.25-2.71	1.25-4.34	1.25-1.25	53.9-248	8.40-51.8
	Mean (LB)		0	7.71	0	14.4	0.542	2.85	0	107	23.7
	Mean (UB)		2.50	7.71	2.60	14.4	2.54	3.35	2.50	107	23.7
	<LOQ/all		5/5	0/5	5/5	0/5	4/5	1/5	5/5	0/5	0/5
	Mean (NE)		0.300	7.71	0.600	14.4	1.85	3.28	1.35	107	23.7
FATS (L)	**Mean (MB)**	**66.3**	**1.25**	**5.57**	**1.30**	**13.6**	**1.58**	**2.47**	**1.25**	**66.6**	**21.7**
N=4	Range (MB)	62.7-70.0	1.25-1.25	2.70-11.3	1.30-1.30	10.7-18.5	1.25-2.55	1.25-4.33	1.25-1.25	37.4-94.8	5.79-47.4
	Mean (LB)		0	4.22	0	13.6	0.638	1.85	0	66.6	21.7
	Mean (UB)		2.50	6.92	2.60	13.6	2.51	3.10	2.50	66.6	21.7
	<LOQ/all		4/4	2/4	4/4	0/4	3/4	2/4	4/4	0/4	0/4
	Mean (NE)		0.288	6.53	0.320	13.6	1.77	2.93	1.32	66.6	21.7

[1] BDE-138 and BDE-183 are excluded since levels were <LOQ for all samples analysed.
[2] Mean values calculated using non-extrapolated levels that are above the limit of detection (LOD) but below the limit of quantification (LOQ).

Table 12.3:2. Levels of PCDD/F and PCB in food homogenates of selected market basket food groups, based on samples collected in five grocery chains in Uppsala, Sweden, in 2010. The market baskets were divided in standard (S) and low (L) price food items. Levels are given in fresh weight and mean values are presented as medium bound (MB), lower bound (LB) and upper bound (UB). N= number of samples analysed per each food group and basket.

		pg TEQ g^{-1} (1998 TEF)			pg TEQ g^{-1} (2005 TEF)			ng g^{-1}		
	Fat %	**∑PCDD/F[1]**	**∑DL-PCB[2]**	**∑Total TEQ[3]**	**∑PCDD/F[1]**	**∑DL-PCB[2]**	**∑Total TEQ[3]**	**∑I-PCB[4]**	**CB-153**	**∑NDL-PCB[5]**
FISH (S, N=5)										
Mean (MB)	**11.0**	**0.178**	**0.308**	**0.488**	**0.139**	**0.240**	**0.382**	**3.12**	**1.09**	**1.47**
Mean (LB)		0.168	0.308	0.474	0.131	0.240	0.370	3.12	1.09	1.47
Mean (UB)		0.188	0.308	0.496	0.152	0.240	0.394	3.12	1.09	1.47
FISH (L, N=4)										
Mean (MB)	**12.2**	**0.208**	**0.323**	**0.530**	**0.165**	**0.255**	**0.418**	**3.28**	**1.18**	**1.49**
Mean (LB)		0.205	0.323	0.528	0.165	0.255	0.418	3.28	1.18	1.49
Mean (UB)		0.210	0.323	0.533	0.170	0.255	0.423	3.28	1.18	1.49
MEAT (S, N=5)										
Mean (MB)	**11.7**	**0.0198**	**0.0280**	**0.0476**	**0.0174**	**0.0234**	**0.0406**	**0.227**	**0.0836**	**0.767**
Mean (LB)		0.0166	0.0280	0.0446	0.0143	0.0234	0.0378	0.227	0.0836	0.767
Mean (UB)		0.0226	0.0280	0.0506	0.0200	0.0234	0.0434	0.227	0.0836	0.767
MEAT (L, N=4)										
Mean (MB)	**11.5**	**0.0120**	**0.0115**	**0.0235**	**0.0106**	**0.00922**	**0.0200**	**0.117**	**0.0403**	**0.0426**
Mean (LB)		0.00818	0.0113	0.0195	0.00680	0.00923	0.0158	0.117	0.0403	0.0426
Mean (UB)		0.0160	0.0115	0.0275	0.0145	0.00923	0.0238	0.117	0.0403	0.0426
DAIRY (S, N=5)										
Mean (MB)	**4.82**	**0.00996**	**0.0122**	**0.0224**	**0.00864**	**0.0107**	**0.0196**	**0.0629**	**0.0259**	**0.0218**
Mean (LB)		0.00654	0.0122	0.0190	0.00526	0.0107	0.0160	0.0625	0.0259	0.0213
Mean (UB)		0.0136	0.0122	0.0258	0.0122	0.0107	0.0230	0.0634	0.0259	0.0223
DAIRY (L, N=4)										
Mean (MB)	**4.68**	**0.00873**	**0.00918**	**0.0183**	**0.00765**	**0.00803**	**0.0160**	**0.0515**	**0.0210**	**0.0182**
Mean (LB)		0.00585	0.00918	0.0150	0.00473	0.00803	0.0128	0.0510	0.0210	0.0178
Mean (UB)		0.0118	0.00918	0.0213	0.0106	0.00803	0.0188	0.0520	0.0210	0.0187

Cont. Table 12.3:2

	Fat %	pg TEQ g^{-1} (1998 TEF) ∑PCDD/F[1]	∑DL-PCB[2]	∑Total TEQ[3]	pg TEQ g^{-1} (2005 TEF) ∑PCDD/F[1]	∑DL-PCB[2]	∑Total TEQ[3]	ng g^{-1} ∑I-PCB[4]	CB-153	∑NDL-PCB[5]
EGGS (S, N=5)										
Mean (MB)	**9.03**	**0.0400**	**0.00858**	**0.0484**	**0.0384**	**0.00706**	**0.0458**	**0.0777**	**0.0270**	**0.0384**
Mean (LB)		0.0294	0.00820	0.0378	0.0284	0.00670	0.0352	0.0774	0.0270	0.0381
Mean (UB)		0.0502	0.00892	0.0592	0.0486	0.00740	0.0564	0.0779	0.0270	0.0388
EGGS (L, N=4))										
Mean (MB)	**8.83**	**0.0480**	**0.0423**	**0.0923**	**0.0455**	**0.0169**	**0.0625**	**1.21**	**0.545**	**0.353**
Mean (LB)		0.0383	0.0423	0.0818	0.0355	0.0169	0.0525	1.21	0.545	0.353
Mean (UB)		0.0583	0.0423	0.100	0.0558	0.0169	0.0728	1.21	0.545	0.353
FATS (S, N=5)										
Mean (MB)	**71.5**	**0.0664**	**0.0356**	**0.102**	**0.0622**	**0.0318**	**0.0940**	**0.183**	**0.0814**	**0.0652**
Mean (LB)		0.000256	0.0356	0.0362	0.000498	0.0318	0.0324	0.181	0.0814	0.0648
Mean (UB)		0.134	0.0358	0.170	0.126	0.0318	0.160	0.185	0.0814	0.0655
FATS (L, N=4)										
Mean (MB)	**69.8**	**0.0685**	**0.0224**	**0.0905**	**0.0645**	**0.0196**	**0.0840**	**0.115**	**0.0500**	**0.0472**
Mean (LB)		0.00013	0.0208	0.0208	0.000385	0.0179	0.0183	0.113	0.0500	0.0467
Mean (UB)		0.138	0.0240	0.160	0.128	0.0213	0.150	0.117	0.0500	0.0478

[1] Sum TEQ of 17 dioxins (PCDD/F).
[2] Sum TEQ of 12 dioxin-like PCB (CB 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169 and 189).
[3] Sum TEQ of 17 PCDD/F and 12 dioxin-like PCB.
[4] Sum of six non dioxin-like PCB, i.e. indicator PCB (CB 28, 52, 101, 138, 153 and 180).
[5] Sum of ten non dioxin-like PCB (CB 66, 74, 99, 110, 128, 141, 170, 183, 187 and 194).

Table 12.3:3. Chlorinated pesticide[1] levels in food homogenates of selected market basket food groups, based on samples collected in five grocery chains in Uppsala, Sweden, in 2010. All samples were standard-price products. Levels are given in ng/g fresh weight and mean values are presented as medium bound (MB), lower bound (LB) and upper bound (UB). N= number of samples analysed per each food group.

	Fat %	p.p'-DDE	p.p'-DDD	p.p'-DDT	HCB	α-HCH	β-HCH	α-Chlordane	γ-Chlordane	Oxy-chlordane	trans-Nonachlor
FISH (N=5)											
Mean (MB)	**10.7**	**2.13**	**0.701**	**0.386**	**0.520**	**0.093**	**0.073**	**0.382**	**0.057**	**0.106**	**0.487**
Range (MB)	8.32-14.3	1.81-2.49	0.595-0.767	0.262-0.470	0.481-0.589	0.073-0.113	0.032-0.084	0.339-0.469	0.032-0.084	0.096-0.141	0.436-0.649
Mean (LB)		2.13	0.701	0.386	0.520	0.093	0.067	0.382	0.045	0.106	0.487
Mean (UB)		2.13	0.701	0.386	0.520	0.093	0.079	0.382	0.070	0.106	0.487
<LOQ/all		0/5	0/5	0/5	0/5	0/5	1/5	0/5	2/5	0/5	0/5
MEAT (N=5)											
Mean (MB)	**12.1**	**0.183**	**0.013**	**0.031**	**0.171**	**0.007**	**0.008**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Range (MB)	10.3-13.4	0.114-0.316	0.013-0.013	0.013-0.069	0.074-0.458	0.007-0.007	0.007-0.014				
Mean (LB)		0.183	0	0.026	0.171	0	0.003				
Mean (UB)		0.183	0.025	0.036	0.171	0.013	0.013				
<LOQ/all		0/5	5/5	2/5	0/5	5/5	4/5				
DAIRY (N=5)											
Mean (MB)	**6.22**	**0.069**	**0.013**	**0.013**	**0.064**	**0.007**	**0.007**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Range (MB)	4.05-9.94	0.047-0.105	0.013-0.013	0.013-0.013	0.040-0.093	0.007-0.007	0.007-0.007				
Mean (LB)		0.069	0	0	0.064	0	0				
Mean (UB)		0.069	0.025	0.025	0.064	0.013	0.013				
<LOQ/all		0/5	5/5	5/5	0/5	5/5	5/5				

Cont. Table 12.3:3

	Fat %	p.p'-DDE	p.p'-DDD	p.p'-DDT	HCB	α-HCH	β-HCH	α-Chlordane	γ-Chlordane	Oxy-chlordane	trans-Nonachlor
EGGS (N=5)											
Mean (MB)	**9.73**	**0.062**	**0.013**	**0.013**	**0.025**	**0.007**	**0.007**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Range (MB)	8.72-10.3	0.013-0.123	0.013-0.013	0.013-0.013	0.016-0.051	0.007-0.007	0.007-0.007				
Mean (LB)		0.059	0	0	0.025	0	0				
Mean (UB)		0.064	0.025	0.025	0.025	0.013	0.013				
<LOQ/all		1/5	5/5	5/5	0/5	5/5	5/5				
FATS (N=5)											
Mean (MB)	**67.5**	**0.429**	**0.065**	**0.065**	**0.197**	**0.032**	**0.032**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Range (MB)	65.7-69.2	0.218-0.573	0.065-0.065	0.065-0.065	0.165-0.215	0.032-0.032	0.032-0.032				
Mean (LB)		0.429	0	0	0.197	0	0				
Mean (UB)		0.429	0.130	0.130	0.197	0.063	0.063				
<LOQ/all		0/5	5/5	5/5	0/5	5/5	5/5				

[1] o.p'-DDT and γ-HCH are not presented because all the values were <LOQ
n.a. = not analysed

12.4 Pesticides

Pesticides were analysed in selected food homogenates from the present market basket project. Each sample consisted of different commodities of similar type mixed together in food groups. The analysed food mixtures belonged to the food groups vegetables, potatoes, fruit, cereal products and meat, respectively. The samples were selected and processed in ways that are described elsewhere in this report (Chapters 6-8).
General information about the use of pesticides is given in section 13.6.

12.4.1 Analytical methods

The method used in these analyses was primarily the Swedish multimethod for pesticide analyses, based on ethyl acetate extraction (SweEt method; Pihlström, T., NFA, 2010-M4; Pihlström et al., 2007), which was applied to vegetables, fruits, and potatoes. Two additional modifications thereof were applied to cereal products (not published: Ekroth, S., 2011, NFA) and meat (not published: Pekar, H., 2011, NFA) (analytical flow schemes in Annex G). All methods used shared the same analytical principle. Five or ten grams of sample material were used and the samples were extracted using 10 or 20 ml of ethyl acetate. After centrifugation and filtration the extracts were analysed using GC- and LC-MS/MS with external quantification standard solutions (mixtures). Using this analytical system close to 400 analytes could potentially be detected and the identities of these are listed in the Annex H.

12.4.2 Accreditation, validation and non-standard procedures

The methods that were used for analysing pesticides in this study are normally used in the Swedish monitoring of pesticide residues in food control under accredited conditions, but these conditions were not fully met in this project. In particular, the methods used were not validated for the mixed sample types that were used in the project, i.e. pooled samples. Furthermore, the pooled samples consisted of some components that have not been validated specifically, e.g. processed food commodities such as macaroni and juices. Nevertheless, the measurement uncertainty for these methods during this application is assumed to be around 50 %, and this percentage is also the default measurement uncertainty that is required for pesticide residue analyses in official food control enforcement within EU. This requirement was clearly met by a great majority of the included pesticides when they were validated using these methods under normal conditions (non-pooled samples, using regular matrices).

The LOQ (Limit of Quantification) was in validation (under normal conditions) found to be 0.01 mg/kg for most pesticides analysed using the methods here discussed. For some of the pesticides the LOQ was 0.05 mg/kg. The LOQ was not optimised to reach below 0.01 mg/kg, although that would be possible for a number of pesticides. However, if the identity of a found pesticide in this project was verified in the chromatography (e.g. two ion transitions), then its concentration was reported even if below LOQ, but presented in italics. LOQs for the analysed pesticides are presented in Annex H.

In this project all samples were frozen and stored before analysis, which is not in line with normal procedures when fruit and vegetables are analysed in Swedish food control. Fruit and vegetables are always analysed in a fresh condition, as soon as possible after arrival at the laboratory. However, this procedural difference is most likely of minor importance for the analytical result.

The number of pooled samples that were analysed was 14 vegetable samples, 14 fruit samples, 14 potato samples, nine cereal samples and nine meat samples. The total number of samples, 60, result from the number of total food baskets (nine) and the fact that vegetables, fruits and potatoes were additionally sampled in the autumn, i.e. five extra samples each from these three food groups.

12.4.3 Analytical results

Pesticides were only found in fruit and vegetables, and not in cereal products, potatoes, or meat. The concentrations of pesticides found in this study are presented in the condensed Table 12.4:1and in more detail in Annex I. Some pesticides were found below LOQ and these results are presented in italics in the table and annex. However, the identity of the pesticides in these cases was confirmed. It should be noted that the fact that samples were pooled means that the pesticides in some cases might have been diluted considerably, in comparison to ordinary non-pooled samples representing specific vegetables/fruits. It is logical that several pesticides might have been diluted to concentrations below LOQ and also might not have been detected. The relative number of findings is in compliance with our experience from the regular monitoring of pesticide residues, if the dilution is considered, and the present findings also reflect those pesticides that are frequently found in general.

Table 12.4:1. Found pesticide concentrations (mg/kg) in the selected market basket food groups vegetables and fruits. Concentrations below LOQ (in mg/kg) are presented in italics.

Pesticide	**Vegetables (n=14)***	**Fruits (n=14)***	**LOQ**
Propamocarb	0.022 (0.010-0.047; n=3)	-	
Thiabendazole		0.029 (0.013-0.099; n=8)	
Pirimicarb		0.016	
Imazalil		0.016 (0.010-0-036; n=8)	
Phosmetoxon		*0.011* (n=1)	0.05
Fludioxinil		0.025	
Fenhexamid		0.016	
Boscalid		0.014 (0.011-0.017; n=4)	
Diphenylamine	*0.002*		0.01
Pyrimethanil	*0.002* (*0.001-0.003*; n=4)	*0.006* (*0.004*-0.011; n=4)	0.01

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*Figures represent means of detected values, and the range and number of values are given in parentheses

12.5 Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of compounds consisting of three or more condensed aromatic rings. PAHs are formed during incomplete combustion processes, whenever wood, coal or oil is burnt. They can therefore be found in complex mixtures throughout the environment, also including a variety of foodstuffs. Food can be contaminated from environmental sources, industrial food processing and during home food preparation. Specific practices such as barbecuing can give rise to high PAH level in the food.

As PAHs represent an important class of carcinogens their presence in food should be as low as possible. Particular attention has been paid to the highly carcinogenic benzo[a]pyrene. The EU Scientific Committee on Food (SCF) has identified 15 PAHs which are of major concern for human health, namely benz[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, cyclopenta[c,d]pyrene, dibenz[a,h]anthracene, dibenzo[a,e]pyrene, dibenzo[a,h]pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene, indeno[1,2,3-cd]pyrene and 5-methylchrysene. For benzo[g,h,i]perylene, however, clear evidence was found for genotoxicity but not for carcinogenic effects (European Commission, 2002). The Joint FAO/WHO Expert Committee on Food Additives (JECFA) has nominated a 16^{th} compound, benzo[c]fluorene, for further observation in food (JECFA, 2005). Maximum levels of benzo[a]pyrene (BaP) in a range of foodstuffs are specified in a Commission Regulation, (Regulation (EC) No 1881/ 2006). Work is currently ongoing to set new maximum levels for BaP alone as well as to include the sum PAH4 (benz(a)antracene, BaP, benzo(b)fluoranthene and chrysene).

12.5.1 Preparation of the food samples

Food is a significant source of PAHs to which humans are exposed and therefore the new market basket project, starting in 2010, included PAH analysis for the first time. Samples were homogenized and stored in a freezer until analyzed. To decrease the number of analyses, equal amounts of samples from all food chains were blended prior to analysis to get one standard-price composite sample (five samples in one pool) and one low-price composite sample (four samples in one pool) for each of the food groups. For beverages only a standard-price market basket was included in the survey. Samples collected in 1999 were analysed together with samples from 2010 and results compared against the corresponding food group. As the samples were not analysed for PAHs in 1999 there might have been some changes in the PAH levels. However, we assume that our results are relevant as the samples have been stored in the dark in a sealed container at -20°C.

12.5.2 Chemical analysis

PAHs were analysed in February 2011 at the National Food Agency, NFA, Sweden in accordance with a GC/MS method described elsewhere (Wretling et al., 2010**)** with some modifications. Briefly, samples from the food groups were spiked with perdeuterated PAHs as internal standards and saponificated in methanolic KOH solution at 70°C. The samples were subsequently extracted with cyclohexane and washed several times with a mixture of methanol and water. Thereafter, samples were cleaned-up on two sets of SPE columns and injected in an Agilent 6890 gas chromatograph connected to an Agilent 5975 mass selective detector. A 30m DB-35ms fused silica column was used for separation. This column can separate chrysene from triphenylene which is of great importance for the parameter PAH4. The analytical method complies with the criteria for official control of BaP in accordance with Commission Regulation (EC) No 333/2007.

12.5.3 Analytical quality control

The method is accredited against ISO 17025 by SWEDAC for 25 PAHs, phenanthrene (Phe), anthracene (Ant),fluoranthene (Flu), pyrene (Pyr), benzo(c)fluorene (BcL), cyclopenta[c,d]pyrene (CPP), benz[a]anthracene (BaA), triphenylene (TP), chrysene (CHR), 5-methylchrysene (5MC), benzo[b]fluoranthene (BbF), benzo[k]fluoranthene (BkF), benzo[j]fluoranthene (BjF), benzo[e]pyrene (BeP), benzo[a]pyrene (BaP), perylene (Per), dibenz[a,h]anthracene (DhA), indeno[1,2,3-cd]pyrene (IcP), benzo[g,h,i]perylene (BgP), anthantrene (ATR), dibenzo[a,l]pyrene (DlP), dibenzo[a,e]pyrene (DeP), dibenzo[a,i]pyrene (DiP), dibenzo[a,h]pyrene (DhP) and coronene (Cor).

The trueness of the method is proven by using certified reference materials and participating in proficiency tests before, during and after the time of analysis. Excellent z-scores all within ±2 were obtained for a number of PAHs in different matrices such as oils, fats, smoked meat, smoked fish, raw fish, infant formula, sausages, mussels, cacao butter and liquid smoke. For daily quality control an in-house control sample, maize oil, runs with each batch of samples. The limit of detection (LOD) is calculated to 0.03 µg/kg.

12.5.4 Analytical results

In Table 12.5:1 results above LOD for BaP, BaA, BbF, CHR and the sum of PAH4 are presented only for the standard-price food groups as the differences between standard-price and low-price samples turned out to be very small.

The results for the twelve food groups were compared to results from seven food groups from 1999. Samples of fish, dairy products, eggs, potatoes and beverages from 1999 were not analyzed as they were considered to be of minor importance for the exposure to PAHs. Only in samples of vegetables from 1999 and dairy products and beverages from 2010 could none of the PAH4 be detected. In fruits and potatoes from 2010 the levels were close to LOD. Generally levels of PAH4 in 1999 were higher than in 2010 except for sugar and sweets where the levels of all PAH4 are slightly higher. The highest level in 1999 for PAH4 was found in pastries, fats and sugar and sweets. For pastries the level is more than five times higher than in 2010. One reason for this might be a change to other types of fats in pastries during the time between the two sampling occasions. In food baskets from 2010 the highest level of PAH4 was found in fats, sugar and sweets and pastries. The total results of the Market Baskets in 2010 indicate that the levels of PAH4 are about half of what they were ten years earlier in 1999. Results for all 25 PAHs in both standard-price and low-price food baskets from 2010 as well as results for seven food groups sampled in 1999 are presented in Annex J.

Table 12.5:1. PAH levels (µg/kg) in standard-price food groups collected in 2010 and 1999

Food	**Benz(a)anthracene**		**Chrysene**		**Benzo(b)fluoranthene**		**Benzo(a)pyrene**		**PAH4**	
Groups	**1999**	**2010**	**1999**	**2010**	**1999**	**2010**	**1999**	**2010**	**1999**	**2010**
Cereal products	0.09	0.03	0.15	0.04	0.07	0.04	0.06	0.03	0.37	0.14
Pastries	0.52	0.07	0.64	0.09	0.23	0.07	0.22	0.05	1.61	0.28
Meat	0.12	0.12	0.10	0.09	0.04	0.03	0.04	0.03	0.30	0.27
Fish	n.a.	0.03	n.a	0.03	n.a.	<0.03	n.a.	<0.03	n.a.	0.06
Dairy products	n.a.	<0.03	n.a	<0.03	n.a.	<0.03	n.a.	<0.03	n.a.	<0.03
Eggs	n.a.	<0.03	n.a.	0.03	n.a.	0.03	n.a.	<0.03	n.a.	0.06
Fats	0.21	0.15	0.29	0.21	0.15	0.14	0.13	0.13	0.78	0.62
Vegetables	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	0.05
Fruits	<0.03	<0.03	0.07	0.03	<0.03	<0.03	<0.03	<0.03	0.07	0.03
Potatoes	n.a.	<0.03	n.a.	<0.03	n.a.	0.03	n.a.	<0.03	n.a.	0.03
Sugar and sweets	0.12	0.14	0.14	0.18	0.07	0.13	0.08	0.10	0.41	0.55
Beverages	n.a.	<0.03	n.a.	<0.03	n.a.	<0.03	n.a.	<0.03	n.a.	<0.03

n.a. = not analyzed

PAH4 = Sum of BaA + CHR + BbF + BaP

13. Exposure estimation and risk assessment

13.1 The concept of benefit and risk assessment

Hazard and risk are two central concepts in risk assessment of chemical compounds in food. The fact that a hazardous compound is found in food does not as such mean that it constitutes a risk. In the risk concept is also included the exposure we are subjected to by the actual compound, that is how large the intake from food is. There is an internationally agreed principle for risk assessment of food contaminants. A risk assessment contains several steps, of which the first is *hazard identification*. This is a qualitative identification of a hazard, which is a compound of intrinsic adverse health characteristics. The next step, *hazard characterization*, examines at what exposure levels the health effects are manifested, and what effect that is observed at lowest level. The third part is *exposure analysis*, i.e. an assessment of how large the exposure is in the population, especially in vulnerable groups. The fourth and concluding part is *risk characterization*, for instance assessing how large is the probability of adverse effects occuring in the population, based on the observed exposure.

It is of importance to gain information about the hazardous compounds, their presence in food and how much we consume of a specific food to be able to perform a risk assessment. Instead of intake calculations, exposure can be estimated by measuring the levels of contaminants in human samples (e.g. blood, breast milk, saliva) and the results give information regarding the body burden, which is a more complete measure of exposure including contributions from other sources than food. The term acceptable (or tolerable) daily intake, ADI (TDI), which represents a lifetime intake level of the actual compound from food that is considered to be without risk, is central in the risk characterization step. The ADI or TDI is obtained by dividing the lowest exposure level not causing negative effects in the most sensitive animal species (no-effect level), often achieved in experimental studies (see hazard characterization above), by an uncertainty factor, the latter inserted to compensate for toxicokinetic and toxicodynamic differences between test animals and man (default value often 100). An estimated intake above the ADI or TDI should preferably result in some kind of action in order to decrease the potentially harmful exposure. This action could be to withdraw the food item from the market, to introduce dietary advice, or to improve food quality and thereby lower the levels of contaminant(s).

13.2 Nutrients

The total energy supply was calculated from Market Basket 2010 data. The present market baskets provide a per capita energy supply of about 12.5 MJ/day, which corresponds to the energy requirement of an adult male with moderate physical activity.

13.2.1 Total fat and fatty acids

The average daily exposure to total fat and the main fatty acid categories are given in Table 13.2:1 and the percentage contribution from food groups in Fig. 13.2:1 and Fig. 13.2:2.

Table 13.2:1. Average exposure to total fat and major fatty acid categories from food groups in the market baskets (grams per person and day)

	FA-factor	**Total fat**	**SFA**	**MUFA**	**PUFA**	**Trans**	**n-6**	**n-3**
Cereal products	0.70	5.09	0.68	1.41	1.47	0.01	1.28	0.18
Pastries	0.95	10.1	4.50	3.77	1.35	0.07	1.14	0.20
Meat	0.95	24.8	10.5	10.2	2.66	0.35	2.30	0.36
Fish	0.90	5.80	0.82	2.60	1.76	0.04	0.87	0.86
Dairy products	0.95	21.6	13.7	5.51	0.85	0.86	0.72	0.13
Eggs	0.83	2.18	0.59	0.90	0.31	0.00	0.27	0.04
Fats	0.956	26.5	9.63	10.6	4.99	0.30	3.86	1.13
Vegetables	0.80	0.39	0.08	0.05	0.17	0.00	0.13	0.04
Fruits	0.80	2.50	0.2	1.5	0.2	0	0.2	0.02
Potatoes	0.95	2.38	0.71	1.33	0.22	0.01	0.22	0.01
Sugar and sweets	0.95	14.6	7.04	5.36	1.50	0.07	1.19	0.31
Sum per day		*116*	*48.3*	*42.1*	*15.3*	*1.70*	*12.0*	*3.30*
% of total FA			45.0	39.2	14.3	1.60	11.2	3.0

SFA = saturated fatty acids
MUFA = monounsaturated fatty acids
PUFA = polyunsaturated fatty acids
Trans = trans fatty acids

For fatty acids the daily exposure was calculated multiplying the value for total fat by the percentage of individual fatty acids, adjusted for the food group-specific factor for fatty acids in fat (see Table 13.1:1).

The average exposure to total fat in the market baskets was 116 g/per person and day, with small variation between the two baskets. Main contributors were fats and oils (23 %), meat (21 %) and milk products (19 %). Pastries contributed 9 %, sugar and sweets 13 %.

The average exposure to SFA was 48 g per person and day. Dairy products contributed 28 %, meat 22% and fats 20 % of SFA. The average exposure to trans fatty acids was 1.7 g per person and day. The main contributors were dairy products

(50 %), followed by meat (20 %), and fats (18 %). Dairy products also contributed the main part of the individual trans isomers (cf. Fig. 13.2:3).

The average exposure to MUFA was 42 g per person and day. Main contributors of MUFA were meat (24 %) and fats (25 %), dairy products, and sugar and sweets each contributed 13 %.

The average exposure to PUFA was 15 g per person and day, of which 11 g was n-6 and 3.3 g was n-3 fatty acids, respectively. The main contributors of n-6 fatty acids (linoleic acid) were fats (32 %) and pastries (19 %). Fats contributed 35 % of n-3 fatty acids (as alfa-linolenic acid) and fish 26 %, mainly as eicosapentanoic acid (EPA) and and docosahexanoic acid (DHA).

The average exposure to individual fatty acids is given in Annex K. Palmitic acid (16:0) was the main SFA followed by stearic (18:0) and myristic acid (14:0). Oleic acid (18:1) was the main MUFA, while linoleic acid (18:2 n-6) was the main PUFA followed by alfa-linolenic acid (18:3 n-3). Long-chain n-3 fatty acids, EPA (20:5 n-3) and DHA (22:6 n-3) contributed 0.1 and 0.2 g per person per day, respectively. Conjugated linoleic acid isomers were found in similar amounts (cf. Fig. 13.2:4)

Conclusions

Results show that SFA contributed almost half (45 %) of the total fatty acids, while MUFA contributed 39 %. PUFA contributed 14 %, of which 11 % was n-6 and 3 % n-3 fatty acids, respectively. TFA contributed 1.6 %. The ratio of n-6 to n-3 fatty acids was 3.7. The proportion of SFA, MUFA and PUFA in the current market basket is at a similar level to that in a previous market basket study from 2005 (Becker et al. 2008) and an earlier food consumption survey (Becker and Pearson 2002) (Table 13.2:2).

Compared to the market basket study of 2005, the supply of total fat is higher, mainly due to larger contribution from sugar and sweets, in which chocolate and ice-cream are high in fat. The observed difference may be due to the fact that ice-cream was under-represented in the 2005 baskets. The content of trans fatty acids was 1.7 gram per person and day, compared to 1.9 g per day in 2005. A major decrease in trans content was seen in pastries, in 2005 pastries contributed 13 % of the total trans fatty acid exposure, compared to 4 % in 2010. The TFA exposure corresponds to about 0.5 E%, which is clearly beneath the WHO recommendation saying that not more than
1 % of the energy intake should come from TFA.

The estimated energy content of the market baskets is about 12.5 MJ per person and day, which is in line with calculations based on the total per capita supply (excluding energy from alcoholic beverages) (SBA 2010). If this figure is used for the market baskets total fat constitutes 34 % of the energy (E%), SFA 14.3 E%, MUFA 12.8 E%, PUFA 4.6 E%, n-6 3.6 E%, n-3 1.0 E% and TFA 0.5 E%. According to the Nordic and Swedish nutrition recommendations, intake of SFA + TFA should be limited to about 10 E%, while intake of PUFA should be 5-10 E%, of which n-3 fatty acids 1 E% (NNR 2004). Thus, the estimated exposure to saturated fatty acids is higher than recommended, while that of of polyunsaturated fatty acids is lower than recommended.

Table 13.2:2. Average exposure to total fat and major fatty acid categories in market baskets analysed in 2005 and 2010 (grams per person and day)

	2005	**2010**
Total fat	108.0	116.0
SFA	46.2	48.3
MUFA	39.1	42.1
PUFA	14.2	15.3
Trans	1.9	1.7
n-6	11.2	12.0
n-3	3.0	3.3

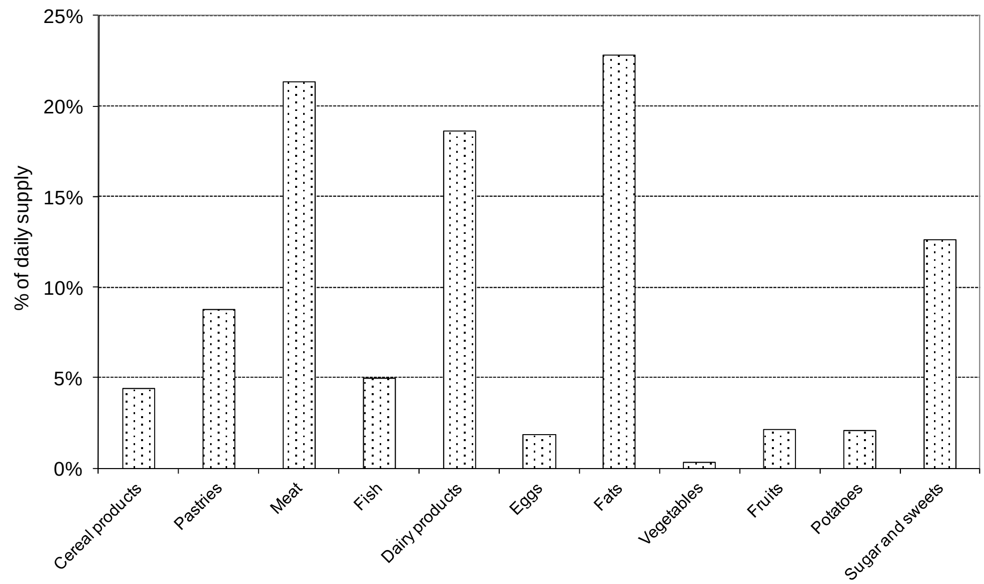

Fig. 13.2:1. Percentage contribution of total fat from food groups.

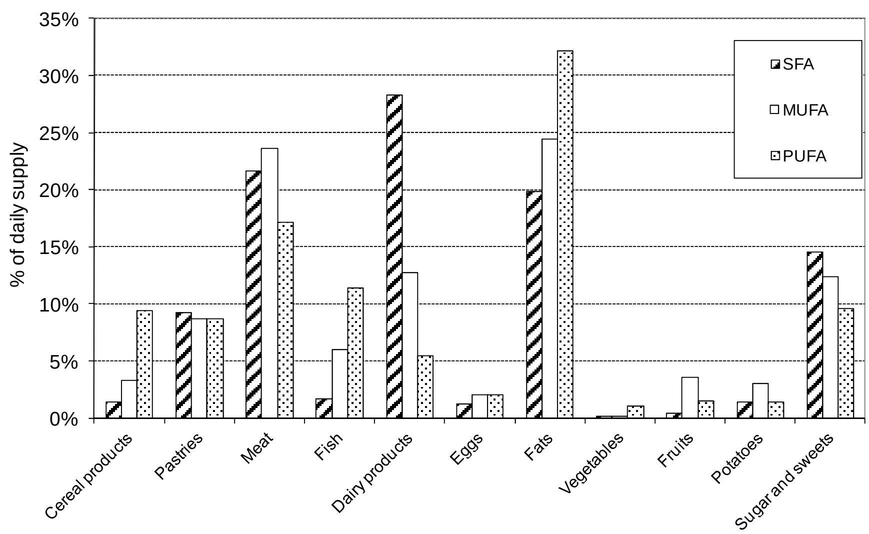

Fig. 13.2:2. Percentage contribution of SFA, MUFA and PUFA from food groups.

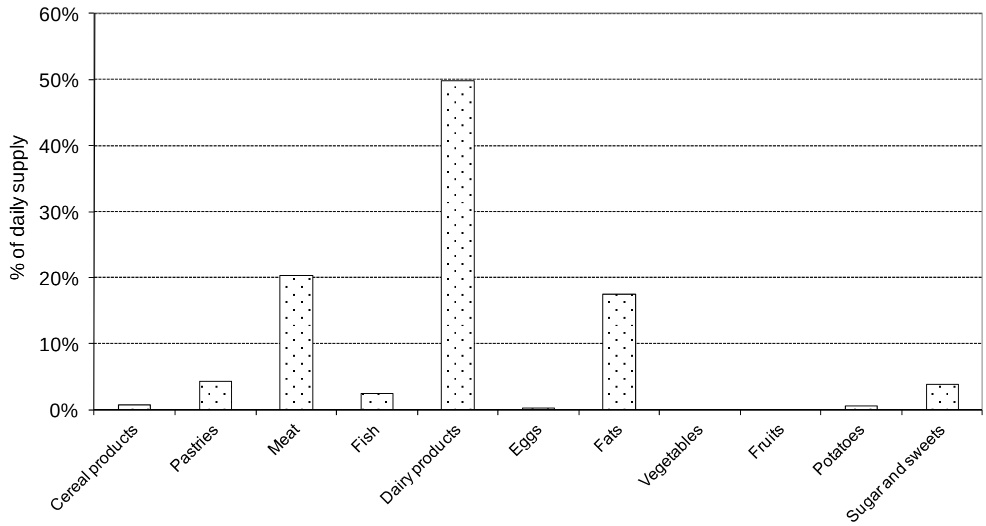

Fig. 13.2:3. Percentage contribution of trans fatty acids from food groups

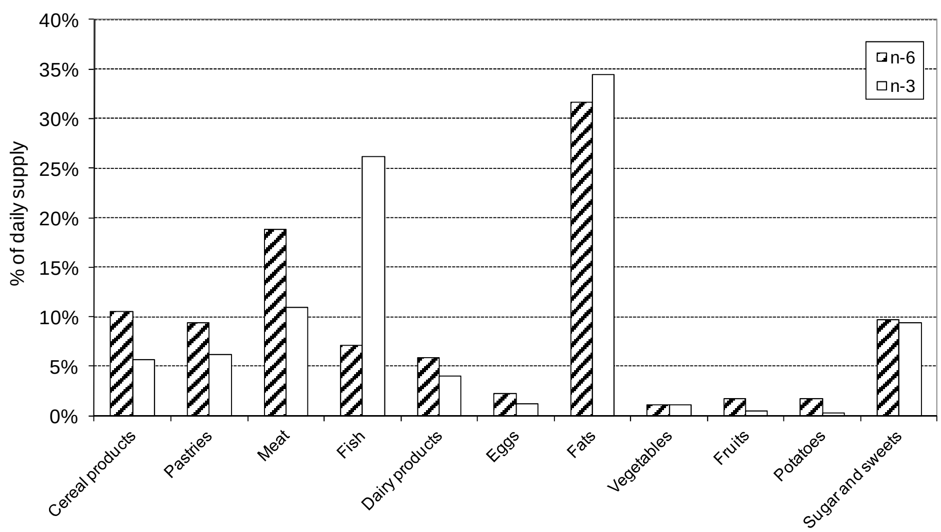

Fig. 13.2:4. Percentage contribution of n-6 and n-3 fatty acids from food groups.

13.2.2 Carbohydrates

The average daily exposure to carbohydrate constituents is given in Table 13.2:3 and the percentage contribution from food groups in Figs. 13.2:5-8. The content of "glycaemic carbohydrates" was calculated as the sum of starch and sugars. The term is defined as carbohydrates that are absorbed in the small intestine and also includes, in addition to starch and sugars, oligosaccharides (Cummings and Stephen 2007).

Starch. The average exposure to starch was 149 g per person per day, of which three quarters is derived from cereal products, while potatoes contribute 13 %.

Monosaccharides. The exposure to glucose and fructose was 32 g per person per day for both, of which fruits contributed about half, and each of the groups cereal products, vegetables, sugar and sweets, and beverages contributed about 10 %.

Disaccharides. The exposure to sucrose was 88 g per person per day, of which sugar and sweets contributed 54 %, while pastries and beverages each contributed 14-15 %. Dairy products contributed on average 83 % of the lactose exposure to 18 g per person per day, sugar and sweets another 12 %. The exposure to maltose was 8.1 g per person per day, cereal products contributing about 60 %, and sugar and sweets contributing an additional 22 %.

Glycaemic carbohydrates. The main contributors of glycaemic carbohydrates were cereal products (37 %), sugar and sweets (19 %) and fruits, incl. jam and cordials, (14 %).

Dietary fibre. The exposure to dietary fibre was 21 g per person per day, cereals contributing about half, vegetables, fruits contributing about one fifth each and potatoes 13 %.

Table 13.2:3. Average exposure to starch, sugars, and dietary fibre (g per person per day) in the market baskets

	Starch	Fibre	Fruc-tose	Glu-cose	Suc-rose	Lac-tos	Mal-tose	Glycaemic CHO
Cereal products	108	9.4	3.0	2.6	0.75	0.49	4.7	120
Pastries	12.7	1.27	0.53	0.69	11.0	0.00	0.39	25.2
Meat	2.7	n.a.	0.11	1.26	0.38	0.20	0.73	5.4
Fish	0.78	n.a.	0.02	0.08	1.01	0.04	0.13	2.1
Dairy products	n.a.	n.a.	0.00	0.55	1.68	15.1	0.00	17.3
Eggs	n.a.	n.a.	0.00	0.00	0.00	0.00	0.00	0.00
Fats	n.a.	n.a.	0.00	0.00	0.00	0.00	0.00	0.00
Vegetables	0.81	3.67	4.1	3.5	0.00	0.00	0.21	8.6
Fruits	0.54	3.9	17.6	15.0	12.4	0.00	0.43	46.0
Potatoes	19.8	2.7	0.43	0.47	0.19	0.00	0.15	21.0
Sugar and sweets	3.7	n.a.	2.5	4.7	47.3	2.6	1.34	62.2
Beverages	n.a.	n.a.	3.6	3.1	13.6	0.00	0.00	20.3
Sum per day	*149*	*20.9*	*31.9*	*32.0*	*88.4*	*18.4*	*8.1*	*328*

n.a. Not analysed

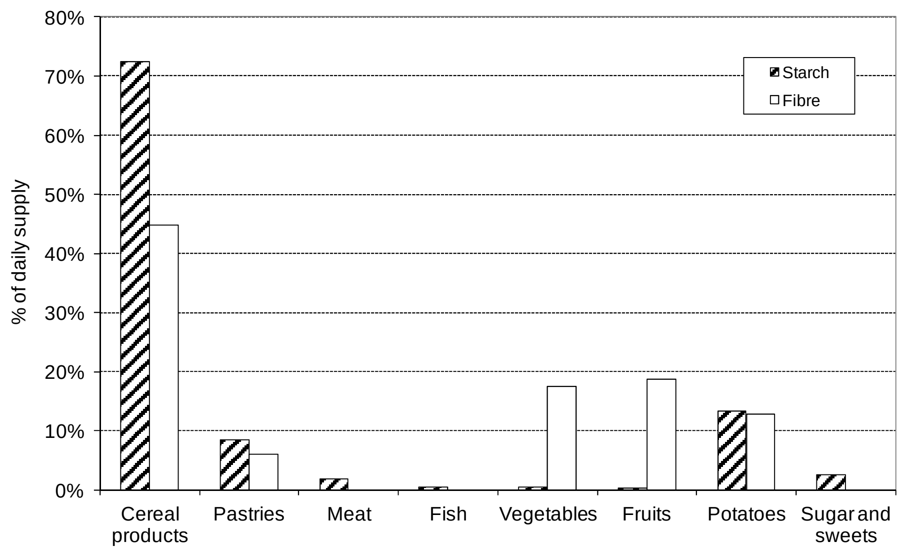

Fig. 13.2:5. Percentage contribution of starch and dietary fibre from food groups.

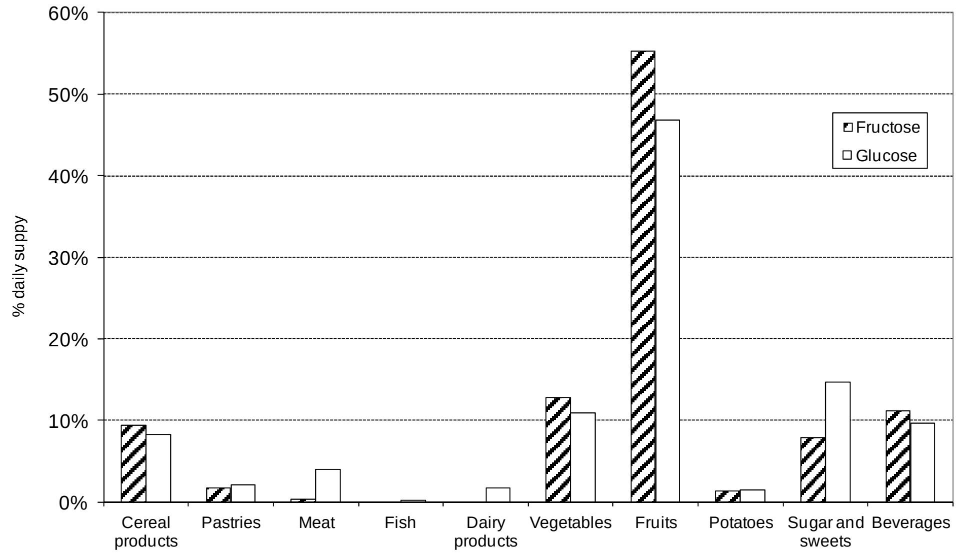

Fig. 13.2:6. Percentage contribution of glucose and fructose from food groups.

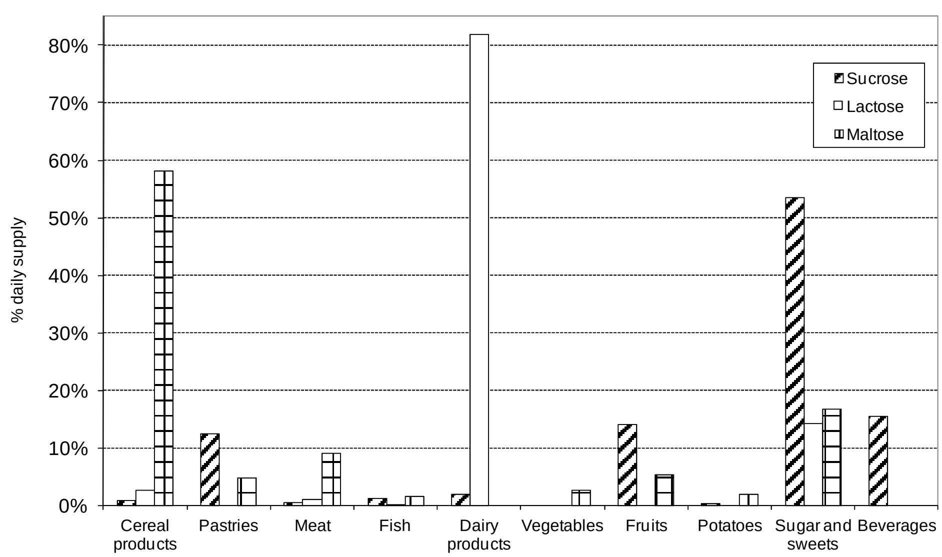

Fig. 13.2:7. Percentage contribution of sucrose, lactose and maltose from food groups.

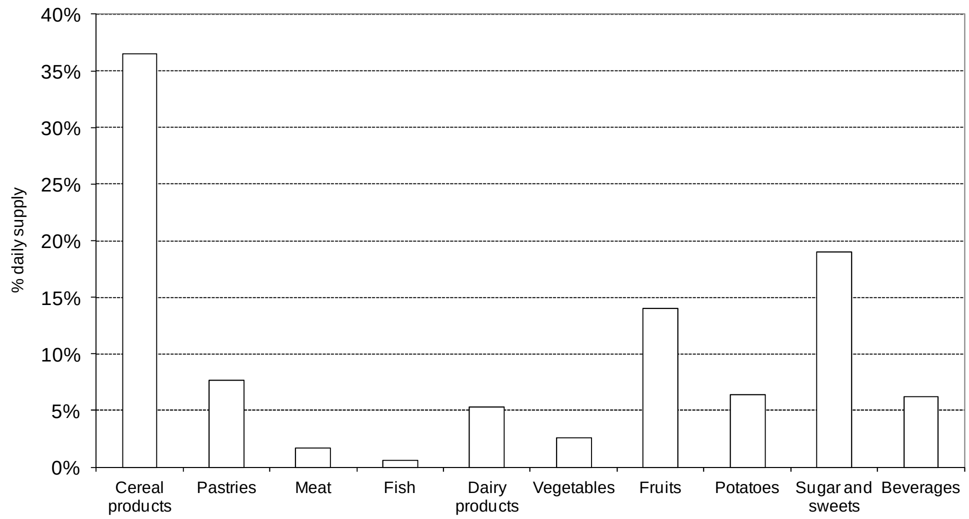

Figure 13.2:8. Percentage contribution of glycaemic carbohydrates from food groups.

Conclusions

Compared to results from a previous market basket study in 2005, the average content of starch and dietary fibre was lower, while the content of sucrose was higher (Table 13.2:4). Using the estimated energy content of 12.5 MJ, monosaccharides contribute 9 % of energy content (E%), sucrose 12 E%, disaccharides 16 E% and total sugars 24 E%. Glycaemic carbohydrates contribute 45 E%. Dietary fibre content corresponds to approx. 1.7 g/MJ. The amount of added sugars has been estimated from the content of mono- and disaccharides in the food groups. Mono- and disaccharides from all food groups, except for fruit, berries, jam and cordials, and potatoes, have been calculated as added. Monosaccharides and sucrose in jam and cordials have also been included, after correction for naturally occurring sugars in the fruits and berries contained. The calculated amount of added sugars was 113 g per person and day, corresponding to approx. 15 E%. The estimates are similar to those from the 2005 market basket (Becker et al. 2009).

The results show that the estimated content of added sugars in the typical Swedish diet is 15 E%, which is higher than the upper limit of 10 E% in the Nordic Nutrition Recommendations (NNR 2004). In the dietary survey of children from 2003 added sugars were calculated to contribute 13-14 E% (Enghardt Barbieri et al. 2006). The calculated content of dietary fibre in the market baskets (1.7 g per MJ), is lower than the recommended level of 3 g per MJ (NNR 2004). Fibre exposure in previous dietary surveys of adults and children was on average 1.7-1.8 g and 1.8-2.1 g per MJ, respectively (Enghardt Barbieri et al. 2006; Becker and Pearson 2002).

13.2.3 Vitamin D

The average exposure to vitamin D and the contribution from food groups are shown in Table 13.2:5. Major sources of vitamin D were fats, fish and dairy. Vitamin D_3 was not detected in meat products. However, data from previous studies show that meat and meat products and other animal products contain varying amounts of 25-OH-D (Mattila et al. 1993, 1995a,b), which has a higher biopotency compared to D_3 (Ovesen et al. 2003). Thus, the estimated exposure is likely to be underestimated. Calculations based on the ingredient lists using data from NFA's food composition database give a higher figure, 8.3 µg per person and day, which is in line with the recommended intake of 7.5 µg (NNR, 2004).

Table 13.2:4. Average exposure to carbohydrates in market baskets analysed in 2005 and 2010 (gram per person and day)

	2005	**2010**
Starch	164	149
Fructose	29	32
Glucose	34	32
Sucrose	74	88
Lactose	20.7	18
Maltose	11	8
Glycaemic CHO	334	328
Fibre	24.8	21

Table 13.2:5. Average daily exposure to vitamin D_3 and percentage contribution from food groups

Food group	**µg/p/d**	**%**
Cereal products	0.25	4
Pastries	0.28	5
Meat	n.d.	-
Fish	1.65	27
Dairy products	1.19	19
Eggs	0.19	3
Fats	2.56	42
Sum	*6.1*	

13.3 Mineral elements

The daily per capita exposure to the mineral elements in the baskets, when estimated from purchase volumes, is shown in Table 13.3:1. The percentage contribution from each food group to the total exposure to the elements is shown in Table 13.3:2. Meat products (31 %) and cereal products (21 %) were the main sources of sodium (Na). The major contributors of zink (Zn) were meat (32 %), cereal (24 %) and dairy products (23 %). Cereal products (32 %) and meat (23 %) contributed most to the exposure to iron (Fe). Cereal products (55 %) were the main source of manganese (Mn) whereas fruits contributed 18 %. The major source of copper (Cu) was cereal products (32 %). Meat (26 %) and fish products (25 %) were the main contributors of selenium (Se). Dairy products and fish (26 %) were the main source of iodine (I), followed by sugar and sweets (21 %). Sugar and sweets were the main sources of chromium (Cr) (39 %). The main sources of molybdenum (Mo) were cereal products (51 %).

Table 13.3:3 shows a comparison of the results from the present study with those of the previous market basket study from 1999 and with results from the national food consumption survey carried out in 1997-98. Compared to the previous study carried out in 1999, the percapita exposure to Na and Cr was higher, while that of I was lower. The lower content of I is mainly due to a decreased iodide concentration in milk (Lindmark-Månsson 2010). No clear trends were seen for Zn, Mn, Cu, and Se.

Table 13.3:1. Average daily per capita exposure to essential minerals

Food group	**Na, mg**	**Fe, mg**	**Zn, mg**	**Cu, mg**	**Mn, mg**	**Se, µg**	**I, µg**	**Mo, µg**	**Cr, µg**	**Co, µg**
Cereal products	678	3.7	2.8	0.43	2.19	5.1	11.1	80.0	3.0	2.5
Pastries	138	0.6	0.38	0.08	0.28	0.7	2.2	8.5	2.1	1.12
Meat	1018	2.6	3.7	0.13	0.08	13.5	11.5	7.9	4.6	0.21
Fish	335	0.2	0.32	0.03	0.01	13.1	32.0	0.5	1.3	0.15
Dairy products	421	0.1	2.7	0.04	0.02	8.1	35.2	24.7	2.6	0.17
Eggs	30	0.4	0.27	0.01	0.01	3.8	7.8	1.3	0.2	0.02
Fats	176	0.0	0.00	0.00	0.00	0.6	n.a.	0.3	0.5	0.01
Vegetables	112	0.8	0.39	0.10	0.23	1.5	2.9	16.2	3.1	0.39
Fruits	10	0.7	0.24	0.20	0.70	1.9	2.0	4.3	3.8	1.66
Potatoes	44	0.5	0.36	0.10	0.16	1.3	1.3	7.3	1.3	0.63
Sugar and sweets	311	1.8	0.50	0.22	0.32	1.5	19.5	5.7	15.1	4.3
Beverages	12	0.0	0.01	0.01	0.01	1.3	0.0	0.50	0.79	0.03
Sum	3285	11.4	11.7	1.3	4.0	52	126	157	38.4	11.3

Table 13.3:2. Average percentage contribution of minerals from food groups

Food group	Na	Fe	Zn	Cu	Mn	I	Se	Mo	Cr	Co
Cereal products	21	32	24	32	55	6	10	51	8	23
Pastries	4	5	3	6	7	2	1	5	6	10
Meat	31	23	32	9	2	9	26	5	12	2
Fish	10	2	3	2	0.4	26	25	0	3	1
Dairy products	11	1	23	3	1	26	15	16	7	2
Eggs	1	4	2	1	0.3	6	7	1	1	0.2
Fats	5	0	0.01	0.1	0.0	0	1	0.2	1	0.05
Vegetables	4	7	3	7	6	2	3	10	8	3
Fruits	0.3	6	2	15	18	2	4	3	10	15
Potatoes	1	5	3	7	4	1	2	5	3	6
Sugar and sweets	11	15	4	16	8	21	3	4	39	39
Beverages	0.4	0.4	0.1	1	0.2	0	3	0.3	2	0.3

Table 13.3:3. Average daily per capita exposure to mineral elements according to the market basket studies and the food consumption survey Riksmaten 1997-98

Element (mg/pers/day)	Market basket study 1999	Present study	Riksmaten 1997-98	Recommended/ Adequate Intakes[c d]
Na	2580[b]	3285	2850/3580[a]	2300/2700
Fe	9.2	11.4	10.4/12.3	15/9
Zn	11.3	11.7	9.9/12.6	7/9
Mn	3.5	4.0	-	*1.8/2.0*
Cu	1.2	1.3	-	0.7/0.9
I	0.20	0.126	-	0.150
Se	0.056	0.052	0.032/0.036	0.040/0.050
Cr	0.025	0.038	-	*0.025/0.030*
Mo	-	0.16		
Co	-	0.011		

a values for females/males
b excluding table salt and condiments containing salt
c NNR, Nordic Nutrition Recommendations, 2004
d Values in italics are from U.S. Institute of Medicine, 2006

Conclusions

The average estimated exposure to most of the essential elements, except iron for women and iodine, was close to or above daily recommended intakes or reference values for adults set by Nordic and U.S. expert committees (U.S. Institute of Medicine, 2006; NNR 2004). As regards iodine, it should however be noted that household salt was not included in the study.

13.4 Toxic metals

The average daily per capita exposure, of toxic metals analyzed (Cd, Hg, Pb, Al, Ag, Ni, As) in the baskets is shown in Table 13.4:1, and the percentage contribution from each food group to the total exposure of the respective metal is shown in Table 13.4:2.

13.4.1 Cadmium (Cd)

For cadmium the daily per capita exposure is estimated to 11.2 µg (Table 13.4:1). This corresponds to a weekly exposure of 1.3 µg/kg b.w. if considering a standard body weight of 60 kg (cf. also the estimated mean body weight for the total population, i.e. 67.2 kg; see chapter 10). This result is quite similar to that obtained in a recent and more detailed assessment of the cadmium exposure in the adult Swedish population where the median intake was estimated to 1 µg/kg. b.w./week (Sand and Becker, 2012). The present results are also similar to those obtained in previous assessments based on market basket analyses in 1987 (12 µg/person/day, i.e. 1.4 µg/kg b.w./week if b.w. 60 kg) (Becker and Kumpulainen, 1991) and in 1999 (10 µg/person/day; 1.2 µg/kg b.w./week) (Becker et al., 2011). According to these assessments there appears to be a margin for Swedish consumers to the tolerable weekly intake of 2.5 µg/kg b.w. established by EFSA (EFSA, 2009a) for a standard consumer. As can be seen in Table 13.4:2, cereals (39 %) and potatoes (19 %) are the main contributors to the cadmium exposure, on average. This observation is also similar to that obtained in Sand and Becker (2012).

13.4.2 Mercury (Hg)

For mercury the daily per capita exposure is estimated to 2.2 µg (Table 13.4:1). This corresponds to a weekly exposure of 0.26 µg/kg b.w. if considering a standard body weight of 60 kg. Similar to the present results, more detailed exposure assessments have indicated an average mercury intake in the range of 0.1- 0.3 µg/kg b.w./week for the adult Swedish population (Ankarberg and Petterson Grawé, 2005). It can be noted that the more detailed assessment in Ankarberg and Petterson Grawé (2005) focused on fish consumption only, while several food groups are covered herein. However, as expected, fish is the main contributor to the mercury exposure (82 %), while other food groups contribute very little to the total exposure, on average (Table 13.4:2). The present results are also similar to those obtained in previous assessments based on market basket analyses in 1987 (1.8 µg/person/day, i.e. 0.21 µg/kg b.w./week if b.w. 60 kg) (Becker and Kumpulainen, 1991), wheras more recent market basket data on mercury is missing. According to these results there is a margin to the exposure limit for methyl mercury of 0.7 µg//kg b.w./week established by the National Research Council (NRC) and the provisional tolerable weekly intake of 1.6 µg/kg b.w./week established by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) (NRC, 2000; JECFA, 2003). It should be noted that total mercury is measured in this analysis, while the NRC and JECFA intake limits concern methyl mercury. However, since mercury in fish is predominantly in the form of methyl mercury, and since fish is the dominant source (Table 13.4:2) the exposure to total mercury in this study is not considered to be a too conservative indicator of methyl mercury.

13.4.3 Lead (Pb)

For lead the daily per capita exposure is estimated to 11.3 µg, which is similar to the cadmium exposure (Table 13.4:1). This exposure is higher than that based on previous market basket analyses in 1999 (7 µg), but lower compared to that obtained in 1987 (17 µg) (Becker et al., 2011). The estimated exposure in this study corresponds to a daily exposure to 0.2 µg/kg b.w. if considering a standard body weight of 60 kg, which can be contrasted to the reference points (RPs) for lead intake that has recently been established by EFSA (EFSA, 2010). For adults, EFSA have established an RP of 0.63 µg/kg b.w./day for chronic kidney disease, and an RP of 1.5 µg/kg b.w./day for effects on systolic blood pressure. According to the present results there is a margin to the RPs for a Swedish standard consumer. While EFSA concludes that there is no evidence for a threshold for critical lead-induced effects, they consider that a margin of exposure (MOE, where MOE = RP / intake) greater than 1 (which applies in this assessment) is associated with a low risk in the case of chronic kidney disease and effects on systolic blood pressure. The main contributors to the exposure of lead is fruit (21 %) followed by potatoes, sugar and sweets, meat, and vegetables (12-14 % each) (Table 13.4:2).

13.4.4 Aluminium (Al)

For aluminium the daily per capita exposure is estimated to 1.6 mg (Table 13.4:1). This exposure is about three times higher compared to that obtained in an earlier study (0.6 mg/kg) for unprocessed foods (Jorhem and Haegglund, 1992). The present results correspond to a weekly exposure of 0.19 mg/kg b.w. if considering a standard body weight of 60 kg. This is lower than the tolerable weekly intake of 1 mg/kg b.w. established by EFSA (EFSA, 2008a). It should be noted that the exposure to aluminium is complex; e.g. amounts released during processing can have a large effect and since this is not accounted for in this assessment the exposure becomes underestimated. For the present data, sugar and sweets are the main contributor to aluminium exposure (31 %) followed by cereal products (18 %) and pastries (15 %) (Table 13.4:2).

13.4.5 Silver (Ag)

For silver the daily per capita exposure is estimated to 7.2 µg (Table 13.4:1). This corresponds to a daily exposure of 2.1 µg/kg b.w. if considering a standard body weight of 60 kg. For silver, there exists no established tolerable intake, reference point, or similar exposure limit. According to WHO (2003) argyria is the only known clinical picture of chronic silver intoxication, a condition in which silver is deposed on skin and hair and in various organs following occupational or iatrogenic exposure to metallic silver and its compounds, or the misuse of silver preparations. Pigmentation of the eye is considered to be the first sign of generalized argyria. WHO (2003) considers that a total lifetime oral exposure of about 10 g of silver can be considered as the human no-observed-adverse effect level (NOAEL). This translates to a daily exposure to 10 / (70*365) = 0.00039 g/day = 390 µg/day (during 70 years). The present estimate of silver exposure is very low in relation to the lifetime NOAEL suggested by WHO. As shown in Table 13.4:2, fruits and cereal products contribute most to the silver exposure on average (22-23 %) followed by potatoes and sugar and sweets (12 % each).

13.4.6 Nickel (Ni)

For nickel the daily per capita exposure is estimated to 125 µg (Table 13.4:1). This corresponds to a daily exposure of 2.1 µg/kg b.w., if considering a standard body weight of 60 kg, which is low in relation to the tolerable daily intake of 12 µg/kg b.w. determined by WHO as part of their establishment of a drinking water guideline for nickel (WHO, 2005). This tolerable intake is based on eczematous reactions in nickel-sensitive individuals. Sugar and sweets (35 %) and cereal products (27 %) contribute most to nickel exposure, on average, followed by fruits (12 %) and pastries (10 %).

13.4.7 Arsenic (As)

For arsenic the daily per capita exposure is estimated to 145 µg (Table 13.4:1). This corresponds to a daily exposure of 2.4 µg/kg b.w. if considering a standard body weight of 60 kg. EFSA have established reference points (RPs) for inorganic arsenic; they identified a range for the RP of 0.3-8 µg/kg b.w./day for cancers of the lung, skin and bladder, as well as skin lesions (EFSA, 2009b). Apparently, the estimated exposure in this study for a standard consumer is within this range. However, total arsenic is measured in the present analysis, and the inorganic forms of arsenic are more toxic as compared to organic arsenic. The relative proportion of inorganic arsenic varies depending on the food product. In particular, the relative proportion is small in fish and seafood. In their assessment, EFSA used occurrence values of 0.03-0.1 mg/kg for fish and seafood products (based on limited data on inorganic arsenic), which they considered were realistic for calculating human dietary exposure (EFSA, 2009b). Using an occurrence value of 0.1 mg/kg for fish in the present assessment, instead of the mean of 2.52 mg/kg (see Table 12.2:3), would approximately reduce the exposure from fish by a factor 25 to about 5 µg/person/day (i.e. 127/25 = 5, using Table 13.3:1). Since fish, according to this study, is the most important contributor to total arsenic (88 %, see Table 13.4:2), such an approach would result in a significant reduction in the (adjusted) exposure of arsenic to about 23 µg/person/day (i.e. 145-127+5, using Table 13.4:1). This corresponds to about 0.4 µg/kg b.w./day, i.e. a value at the lower end of the RP range established by EFSA.

Table 13.4:1. Average daily exposure to toxic metals.

Food group	**Cd (µg)**	**Hg (µg)**	**Pb (µg)**	**Al (mg)**	**Ag (µg)**	**Ni (µg)**	**As (µg)**
Cereal products	4.4	0.07	0.7	0.3	1.6	34	6.9
Pastries	0.6	0.02	0.2	0.2	0.4	13	1.5
Meat	0.4	0.04	1.5	0.2	0.6	2.3	2.7
Fish	0.3	1.8	0.4	0.01	0.2	0.9	127
Dairy products	0.04	0.05	0.4	0.01	0.01	2.1	0.5
Eggs	0.05	0.01	0.3	0.001	0.2	0.3	0.4
Fats	0.2	0.01	0.7	0.004	0.3	0.7	1.3
Vegetables	1.5	0.04	1.4	0.1	0.6	7.9	2.5
Fruits	0.3	0.07	2.4	0.2	1.7	15	0.7
Potatoes	2.1	0.04	1.6	0.03	0.9	3.6	0.4
Sugar and sweets	1.1	0.04	1.6	0.5	0.9	44	0.5
Beverages	0.1	0.01	0.2	0.04	0.01	1.5	0.2
Sum	*11.2*	*2.2*	*11.3*	*1.6*	*7.2*	*125*	*145*

Table 13.4:2. Average percentage contribution of toxic metals from different food groups

Food group	**Cd (µg)**	**Hg (µg)**	**Pb (µg)**	**Al (mg)**	**Ag (µg)**	**Ni (µg)**	**As (µg)**
Cereal products	39	3	6	18	22	27	5
Pastries	5	1	2	15	5	10	1
Meat	4	2	13	10	9	2	2
Fish	2	82	3	1	3	1	88
Dairy products	0.4	2	4	1	0.1	2	0.4
Eggs	0.4	0.3	3	0.04	2	0.2	0.3
Fats	2	1	6	0.2	4	1	1
Vegetables	14	2	12	8	8	6	2
Fruits	3	3	21	11	23	12	0.5
Potatoes	19	2	14	2	12	3	0.3
Sugar and sweets	10	2	14	31	12	35	0.3
Beverages	1	0.4	2	2	0.1	1	0.2

13.4.8 Conclusions

The present results, applicable for a standard/average adult consumer, are generally not indicative of a health concern. Arsenic could potentially be an exception, and estimated exposures are probably most uncertain for aluminium, as discussed. For cadmium and lead the per capita exposures are not very far from health-based reference values, and in case of lead a higher per capita exposure at present compared to the 1999 market basket study could be noted. Also, note that tap water, coffee, tea, and wine and other alcoholic beverages are not included in this study, which in some cases could have consequences for assessment of the total exposure. This assessment does not account for variability in exposure between individuals and this aspect can be of relevance for many of the toxic metals analysed.

13.5 Persistent organic pollutants (POPs)

13.5.1 Brominated flame retardants

Brominated flame retardants (PBDEs and HBCD) were analysed in food samples from standard- and low-price baskets. Mean concentrations are presented in Table 13.5:1. In the market basket studies from 1999 and 2005, per capita exposure estimates were based on extrapolation of PBDE (and in 2005 also HBCD) levels, in those cases they were below LOQ, to 0 (lower bound), half of the LOQ level (medium bound) or to the LOQ level (upper bound) (Darnerud et al., 2006; Törnkvist et al., 2011). In 2010, an effort was made to more precisely estimate PBDE and HBCD levels below LOQ, by estimating levels above LOD, i.e. between LOD and LOQ. These non-extrapolated levels were used in the exposure calculations in cases when levels were below LOQ (see Table 12.3:1). A comparison of these PBDE exposures with medium-bound exposures (levels <LOQ = ½ LOQ) showed that the extrapolation of levels below LOQ to ½ LOQ caused an over-estimation of the total per capita exposure (Table 13.5:1). Over-estimation was especially large in cases when levels of the flame retardant were below the LOQ in the majority of the food group baskets, as in the case of BDE-183.

Among the flame retardants analysed, BDE-47, BDE-209 and HBCD showed the highest total per capita exposure followed by BDE-99 and BDE-100 (Table 13.5:1). No marked differences in total per capita exposure to flame retardants between food stores were observed (at most 3-fold). Moreover, no significant difference was found between exposures from normal price baskets and low price baskets (Mann-Whitney U test, $p>0.05$, N=4-5), showing a homogenous contamination pattern of foods on the Swedish market. Eggs showed the widest ranges in PBDE concentrations (in some cases 10-fold) when exposures from individual food group baskets were compared between stores (Table 13.5:1).

In 2011 the CONTAM panel of EFSA assessed the human health risks with dietary intake of PBDEs and HBCD (EFSA, 2011b,c). The data base did not allow for determination of health-based tolerable intakes. Moreover, no assessment of health risks connected to the total intake of PBDEs could be done. However, the panel used benchmark modeling in order to determine the lower-bound 90^{th} percentile (BMDL) intake of single PBDE congeners based on the BMDL body burden associated to a

10 % increase in neurodevelopmental effects in mice. Using these BMDL intakes the panel concluded that the current margin of exposure (MOE) between the BMDL and the intake of BDE-47, -153 and -209 and HBCD from food within the EU does not raise health concerns. For BDE-99, however, the panel concluded that there is a potential health concern with respect to current dietary exposure. The CONTAM panel stated that in the case of PBDEs in principle any MOE larger than 2.5 indicates that there is unlikely to be a health concern. The larger the MOE is, the smaller is the potential health concern (EFSA, 2011b).

Based on the total per capita exposure estimated in the Swedish market basket study, the margin of exposure (MOE) between the current average exposure of BDE-99 among adults in Sweden and BMDL intake are estimated to be 60-108 (Table 13.5:2). In this calculation a body weight of 67.2 was used (cf. Chapter 10). The MOE is most probably lower in certain subgroups of the Swedish population, for instance groups with high consumption of fish. Moreover, children consume more food per kilo body weight than adults, which could result in a lower MOE. For BDE-47, BDE-153 and BDE-209 and HBCD the MOEs between the per capita exposures and BMDL intake were more than 500.

Current knowledge about possible mixture effects of PBDEs and HBCD on health is not comprehensive enough to make a reliable risk assessment of the mixture of brominated flame retardants detected in the market baskets. However an effort was made to do a rough and most probably conservative assessment based on the risk assessment performed by EFSA (EFSA 2011b,c). In this case each flame retardant in the baskets was assigned a relative potency factor (Repf), describing the toxicity of the compound in relation to the most toxic BDE-99. The BMDL intakes estimated for neurotoxicity by EFSA were used in the assignment of Repfs, with the BMDL intake of BDE-99 as a reference point (Repf=1). Using this approach BDE-47 was assigned a Repf of 0.02, BDE-153 0.43, BDE-209 $2.5*10^{-6}$, and HBCD a Repf of 0.001. The PBDEs analysed by us that lacked BMDL data for neurotoxicity (BDE-28, -66, -100, -154 and -183) was in this conservative approach assigned a Repf of 1. The mean exposures of the single flame retardants were then multiplied by its respective Repf, and the resulting exposures were added together to a total mean exposure (10 ng/day). With the use of a body weight of 67.2 kg an exposure of 0.14 ng/kg body weight/day was estimated. The MOE between this exposure and the BMDL for the most toxic BDE-99 was 29, which is considerably higher than the MOE of 2.5 proposed by EFSA as being unlikely to be a health concern (EFSA, 2011b).

For most PBDE congeners and HBCD the fish group gave the highest contribution to the total per capita exposure, except for the higher brominated congeners BDE-183 and BDE-209. In these cases meat, and for BDE-209 also fats, contributed more than fish to the exposure (Table 13.5:3). This suggests a difference in contamination pathways of foods between higher brominated PBDEs and lower brominated PBDEs and HBCD.

In the market basket studies from 1999 and 2005 non-extrapolated levels of brominated flame retardants were not reported in cases when levels were below

LOQ. Only BDE-47 and -99 were generally present at levels above the LOQ, in this case in the 1999 study. Consequently in the analyses of temporal trends of per capita exposures only data from 1999 and 2010 for BDE-47 and -99 could be used. Statistical analyses showed that the total per capita exposure of brominated flame retardants was significantly lower in 2010 than in 1999 (Fig. 13.5:1). This comparison is made with the reservation that data from 2010 were more uncertain than data from 1999, since the majority of reported levels were above LOQ in 1999 but not in 2010. Nevertheless the results suggest that the efforts to decrease emissions of lower brominated PBDEs have resulted in lowered contamination of foods.

Trend analyses were also done for per capita exposures from the fish groups in market baskets sampled in 1999, 2005 and 2010 (Fig. 13.5:2 and Fig. 13.5:3). For BDE-47, -99 and -100 significant declining trends were observed, further supporting the positive effects of risk reducing measures against emissions. No significant trend for BDE-154 was evident (Fig. 13.5:2). Regarding HBCD no difference in exposure from the fish baskets was seen between 2005 and 2010 (Fig. 13.5:3). In all these cases an observed increase in per capita fish consumption between 1999 and 2010 has to be taken into consideration when looking at the exposure trends.

13.5.2 PCBs and PCDD/Fs

PCBs were analysed both in standard price (N=5) and low price (N=4) baskets. CB-153 was the dominant PCB congener in the baskets, and contributed with about 20 % to the exposure of total PCB (28 congeners) (Table 13.5:4). No differences in PCB exposures between normal price and low price baskets were observed (Mann-Whitney U test, $p>0.05$, N=4-5), showing a homogenous PCB contamination pattern on the Swedish food market. However, the exposure from eggs varied considerably (100-fold) between baskets, mainly due to a high exposure from one “low price” basket. The reason for this high contamination in one egg basket may be due to inclusion of eggs contaminated in an isolated incident of high PCB levels in hen´s feed, or an inclusion of eggs from an egg-producing facility with high PCB contamination in the environment of the hens. In the studies from 1999 and 2005 the PCB levels in the egg baskets were relatively low and also the variation was low (Darnerud et al., 2006; Törnkvist et al., 2011).

Exposure of PCB is dominated by exposure of non-dioxin-like (ndl-) PCBs. In 2005 the CONTAM-panel of EFSA did a risk assessment of ndl-PCBs in food (EFSA, 2005). The panel did not decide on a tolerable intake of ndl-PCB due to a limited toxicological database. However, no adverse exposure levels (NOAELs) of 30-40 µg ndl-PCBs/kg body weight/day were observed in animal studies, with liver and thyroid toxicity as the most sensitive endpoints. It was pointed out that it could not be excluded that some of these effects could have been caused by contamination of the ndl-PCBs with dioxins and/or dioxin-like (dl-) PCBs. Nevertheless, a worst case assessment, assuming that the effects were caused by ndl-PCBs, suggests a margin of exposure between intakes at NOAEL and the per capita exposure to ∑PCB (28 congeners) in the market baskets from 2010 (0.4 µg ndl-PCB/kg body weight/day, body weight 67. 2 kg) of about 100. The panel also estimated a NOAEL human body burden of ndl-PCB to approximately 2.4 µg/g lipid (EFSA, 2005), which is close to the maximum levels of ∑PCB detected in blood serum/ plasma among older Swedish consumers (Ankarberg et al., 2007).

Regression analyses showed declining trends of ∑PCB and CB-153 exposure between 1999 and 2010 (Fig. 13.5:4). The decline was most pronounced between 1999 and 2005. Studies of temporal trends of PCBs in mother´s milk from nursing women have shown that the human exposure to ndl-PCBs has declined considerably since the early 1970s (Norén and Meironyté, 2000; Lignell et al., 2009). Whether this decline is now leveling off, as indicated in the market basket studies, has to be confirmed in future follow-up studies of human PCB exposure in Sweden.

As with many of the brominated flame retardants, the fish baskets gave the largest mean contribution to the total per capita exposure to PCBs (>50 %), followed by meat and dairy products (Table 13.5:3). This is in line with the results of the 1999 and 2005 market baskets (Darnerud et al., 2006; Törnkvist et al., 2011). The high PCB levels in one of the egg baskets resulted in a relatively high contribution of eggs to the total per capita exposure from the market basket in question (Table 13:3:3). This shows that eggs in some cases can give a high contribution to the total exposure to PCBs. Interestingly, positive associations between egg consumption and PCB levels in mother´s milk were found among primiparous women from the Uppsala area of Sweden (Lignell et al., 2011), further supporting the belief that egg consumption could give a significant contribution to the human exposure to PCBs.

The estimated lower-bound mean total per capita exposure to TEQs of PCDD/Fs and dl-PCBs was 24 % lower than the upper-bound exposure, due to some PCDD/F congeners showing levels below the LOQ (Table 13.5:4). Differences between lower-bound and upper-bound exposure to dl-PCBs were small. Similarly as in 2005, the PCDD/Fs and dl-PCBs gave an almost equal contribution to the ∑PCDD/F+dl-PCB TEQ exposure (Törnkvist et al., 2011). Differences in total per capita exposure of ∑PCDD/F+dl-PCB TEQs varied little between the food stores (Table 13.5:4). No difference in exposures from normal price baskets and low price baskets was seen (Mann-Whitney U test, p>0.05, N=4-5), except in the case of a significant lower exposure of dl-PCB TEQs from low price baskets (Mann-Whitney U test, $p \leq 0.05$, N=4-5). Similarly as for ∑PCB and CB-153, the variation in exposure to dl-PCB from eggs was large, although not as large as for the ndl-PCBs (Table 13.5:4).

In 2001 the tolerable intake of PCDD/F and dl-PCBs was set to 14 pg TEQ/kg body weight/week by the EU Scientific Committee on Food, and to 70 pg TEQ/kg body weight/month by the WHO expert group JECFA (SCF, 2001; JECFA, 2001). This corresponds to a daily intake of approximately 2 pg TEQ/kg body weight/day. These tolerable intakes were based on developmental effects of the most toxic dioxin congener TCDD in offspring of exposed female rats (SCF, 2001; JECFA, 2001). Consequently, the tolerable intake is relevant for girls and women of a child-bearing age that bioaccumulate the contaminants before pregnancy. Assuming an average body weight of 62.3 kg for women (see Chapter 10) the mean total per capita exposure to TEQ (medium-bound) corresponds to 0.62 pg TEQ/kg body weight/day, which is more than 3 times lower than the tolerable intake. For younger girls the difference between the per capita exposure and the tolerable intake is most probably lower than for adults due to the higher food consumption per kilo body weight.

This is illustrated by calculations of PCDD/F and dl-PCB intake among 4-year-old children participating in the population-based survey Riksmaten 2003 (Ankarberg et al., 2007). Based on food consumption data from 2003 and PCDD/F and dl-PCB levels in food sampled after the turn of the millennium, it was estimated that the average TEQ intake among 4-year-old children was slightly above 2 pg TEQ/kg body weight/day (Ankarberg et al., 2007). However, the higher exposure in early childhood is compensated by a considerably lower exposure in adolescence and adulthood, as shown by the relatively low per capita exposure in 2010. Taken together the results show that the average long-term TEQ exposure among women of a child-bearing age in Sweden is below the tolerable intake.

There is no internationally established health-based tolerable intake of PCDD/Fs and dl-PCBs for boys, men and older women. Hanberg et al. (2007) proposed a TEQ intake range of 2-10 pg/kg body weight/day as intake levels that cause negligible health effects during non-developmental PCDD/F and dl-PCB exposure. Cancer and immunological effects were the most sensitive endpoints in the animal studies used in the development of the tolerable intake range (Hanberg et al., 2007). The estimated per capita exposures of PCDD/F + dl-PCB TEQs from the 9 market baskets in 2010 were considerably lower than this proposed intake range (Table 13.5:4).

As with PCBs a significant decreasing trend of per capita exposure of PCDD/Fs + dl-PCBs TEQ was observed between 1999 and 2010, with the largest decrease between 1999 and 2005 (Fig. 13.5:4). Biomonitoring of temporal trends of body burdens of PCDD/F and dl-PCB TEQs in pregnant and nursing women in Sweden show a continuous decline in body burdens between 1996 and 2006 (Lignell et al., 2009). A complicating factor when interpreting the results of the temporal trend analyses is that different laboratories have done the analyses of PCDD/F and dl-PCBs in the market baskets from 1999, 2005 and 2010. Further follow-up of biomonitoring and market basket studies is needed in order to draw conclusions about whether the declining temporal trends of TEQ exposure are leveling off.

Fish gave the largest contribution to the total per capita exposure of PCDD/F + dl-PCB TEQs, but to lesser degree than for PCB (Table 13.5:3). This was due to a lower percentage of contribution for PCDD/F TEQs from the fish baskets (medium-bound mean 43 %) to the total TEQ exposure than for PCB TEQs (59 %). This could to some extent be due to an over-estimation of the total per capita exposure to TEQ from PCDD/F due to levels of some congeners being below the LOQ in other food group baskets than the fish baskets. The mean contribution of fish to the lower-bound PCDD/F TEQ exposure was 58 %. Meat and dairy products contributed about 20 % each to the total per capita exposure of total TEQ intake (medium-bound) (Table 13.5:3).

13.5.3 Chlorinated pesticides and metabolites

The compounds were only measured in "standard price" baskets, and HCB and p,p'-DDE were present at high enough levels in all food groups to allow for calculations of total per capita exposure (Table 13.5:4). The total per capita exposure of p,p'-DDE was about twice as high as that of HCB, but the exposures in both cases differed less than 3-fold between the food stores. The similarities in exposures from the different food store baskets were further supported by the relatively narrow ranges of exposures to p,p'-DDE and HCB for the different individual food groups (Table 13.5:4). In most cases the ranges of exposures were less than 3-fold, with the exception of a 10-fold range in p,p'-DDE exposure (medium-bound) from eggs and a 6-fold range in HCB exposure from meats and meat products (Table 13.5:4).

A provisional acceptable daily intake of DDT compounds was established by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR-FAO/WHO) to 10 µg/kg body weight/day (JMPR, 2000). Using a body weight of 67.2 kg (see Chapter 10), the estimated medium-bound per capita exposure of p,p'-DDE from the 2010 market baskets ranged between 2.5 to 2.9 ng/kg body weight, which is more than 1000 times lower than the intake considered safe for consumers by JMPR. The most sensitive health effect in the animal studies used in the risk assessment was developmental effects. In another risk assessment of DDT compounds, performed by JECFA-WHO in 2010, it was concluded that body burdens of DDT compounds below 1 µg/g lipid are safe from a human health perspective (developmental effects and cancer) (JECFA, 2011). In Sweden p,p'-DDE body burdens are generally below 1 µg/g lipid (Ankarberg et al., 2007), which further suggests that the current exposures to p,p'-DDE are of no health concern in Sweden.

In the risk assessment of HCB in drinking water, WHO has proposed a health-based guidance value for HCB intake of 160 ng HCB/kg body weight/day, based on animal studies of cancer (IPCS, 1997). The per capita exposure to HCB in the 2010 market basket ranged from 1.0 to 2.5 ng HCB/kg body weight/day, which is approximately 100-fold lower than the proposed guidance value.

An analysis of the trends of per capita exposure of p,p'-DDE and HCB, based on the results from the market basket studies in 1999, 2005 and 2010, show decreasing trends of total per capita exposure to p,p'-DDE and HCB (Fig. 13.5:5). However, for HCB no decreasing trend was evident when an outlier (in 2010) was included in the regression analysis. Decreasing p,p'-DDE and HCB exposure of the consumers in Sweden is supported by decreasing body burdens of the compounds among pregnant and nursing women between 1996 and 2008 (Lignell et al., 2009).

Most of the pesticides/metabolites analysed were only measured in the fish baskets, since earlier studies in 1999 and 2005 showed that levels were generally below LOQ in other food group baskets. For the fish baskets in 2010, the per capita exposures decreased in the order p,p'-DDD>p,p'-DDT~α-chlordane~trans-nonachlor>γ-chlordane~oxychlordane~α-HCH~β-HCH (Fig. 13.5:6 and 13.5:7). Generally, the ranges of exposures to the different compounds from the fish baskets were narrow. The exposures to p,p'-DDE from the fish baskets were considerably higher than the exposure to the other DDT-compounds (Table 13.5:4 and Fig. 13.5:6), confirming that p,p'-DDE is the dominant DDT compound in food on the Swedish market.

A trend analysis of pesticide/metabolite exposure from the fish baskets showed varying trends for different compounds (Fig. 13.5:6 and Fig. 13.5:7). Decreasing trends between 1999 and 2010 were observed for α-chlordane, γ-chlordane, trans-nonachlor and α-HCH. A closer look at these decreasing trends suggests that most of the decline occurred between 1999 and 2005. However, future follow-ups of the trends have to be done before firm conclusions can be drawn about the probability of a cessation of intake declines of the compounds in Sweden. No significant trends were seen for β-HCH, p,p'-DDT, p,p'-DDD and oxychlordane in the fish baskets (Fig. 13.5:6 and Fig. 13.5:7). One factor to consider in the trend analyses of per capita exposure from fish is that the per capita fish consumption has increased between 1999 and 2010.

Fish consumption gave the largest contribution to the total exposure to p,p'-DDE followed by meat and dairy products (Table 13.5:3). HCB showed a different contamination pattern, with fish, meat and dairy products giving a similar contribution to the total exposure. The difference in contribution pattern between p,p'-DDE and HCB in the 2010 market basket is in agreement with the observations in the 2005 market basket (Törnkvist et al., 2011).

13.5.4 Conclusions

The calculations of per capita exposures to PBDEs, HBCD, PCBs, PCDD/Fs, and chlorinated pesticides show that the average exposure to these compounds from food on the Swedish market in most cases has decreased significantly between 1999 and 2010. The per capita exposures to all the POPs were low in 2010 and based on the current knowledge about toxicity of individual substances these average exposures are most probably not a health concern. However, the substances are present as a mixture in the sampled foods, which points to the possibility of a mixture effect. In many cases the margins are large between the per capita exposure to individual substances and intake levels suspected to increase the risk of health effects caused by the substance in question. In these cases it may be suspected that even if the concentrations of single compounds are added together, and a similar mode of action and potency is assumed, the resulting mixture level will not be high enough to reach levels that markedly increase the risk of health effects.

A mixture effect is most likely in the case when substances with the same mode of action is present in the mixture. In the case of PCDD/Fs and dl-PCBs the substances in the mixture acts via the same toxic mechanism. For this substance group, the composition of the whole mixture has been taken into account by the use of toxicity equivalent factors (TEFs). In this case each substance in the mixture has been assigned with a TEF, based on experimental data on the toxicity of the substance in relation to the most toxic PCDD, 2,3,7,8-tetrachloro-p-dioxin (TCDD). For PCDD/Fs and dl-PCBs it has been shown that the compounds act in an additive manner in mixures. Consequently, by multiplying the measured concentration of a PCDD/F or dl-PCB substance with its TEF a concentration of toxicity equivalent (TEQ) is calculated. The concentrations of TEQs of individual PCDD/Fs and dl-PCBs in the food sample are then added together to a concentration of total TEQ. These total TEQ levels can the be used in the exposure calculation, and the resulting exposure to total TEQ is compared with the tolerable intake of PCDD/F and dl-PCB TEQ.

For other compounds that do not act via the same mechanism of toxicity, but acts within a common toxic pathway, current knowledge is not comprehensive enough to make a reliable risk assessment of the mixture possible. The conservative risk assessment of the mixture of brominated flame retardants performed above indicates that the current per capita exposure to the compound group is not a health concern (a MOE of 29). However, if non-dioxin-like PCBs, PCDD/Fs, and the chlorinated pesticides act via the same toxicological pathways, then the MOE may be lower. Future research on mixture toxicology will hopefully fill in the gaps in knowledge about mixture toxicity of POPs.

Table 13.5:1. Total per capita exposure to brominated flame retardants (mean (range)).

Compounds	Fish	Meat	Dairy products	Eggs	Fats	Total
BDE-28 (ng/d)						
NE level exposure	0.476 (0.371-0.588)	0.044 (0-0.089)	0.016 (0-0.034)	0.003 (0-0.005)	0.012 (0.008-0.014)	0.551 (0.471-0.605)
BDE-47 (ng/d)						
NE level exposure	7.23 (5.63-9.33)	0.420 (0-0.665)	0.487 (0.222-1.22)	0.0346 (0.005-0.140)	0.285 (0.155-0.449)	8.46 (6.93-10.5)
BDE-66 (ng/d)						
NE level exposure	1.29 (0.618-2.10)	0	0	0	0.019 (0.006-0.038)	1.30 (0.626-2.11)
BDE-99 (ng/d)						
NE level exposure	1.51 (1.05-2.28)	0.659 (0.322-1.03)	0.611 (0.333-1.23)	0.091 (0.030-0.221)	0.558 (0.425-0.735)	3.43 (2.64-4.68)
BDE-100 (ng/d)						
NE level exposure	1.86 (1.29-2.56)	0.171 (0.094-0.233)	0.167 (0.115-0.302)	0.027 (0.008-0.080)	0.072 (0.051-0.108)	2.30 (1.89-2.76)
BDE-153 (ng/d)						
NE level exposure	0.387 (0.285-0.588)	0.204 (0.110-0.322)	0.088 (0-0.213)	0.036 (0.011-0.064)	0.124 (0.086-0.172)	0.839 (0.743-1.02)
BDE-154 (ng/d)						
NE level exposure	1.15 (0.846-1.66)	0.112 (0.069-0.185)	0	0.019 (0-0.067)	0.053 (0.028-0.087)	1.33 (1.09-1.81)
BDE-183 (ng/d)						
LB	0	0	0	0	0.034 (0-0.310)	0.034 (0-0.034)
MB	0.063 (0.063-0.063)	0.260 (0.260-0.260)	0.533 (0.533-0.533)	0.029 (0.029-0.029)	0.079 (0.050-0.310)	0.964 (0.935-1.20)
UB	0.127 (0.127-0.127)	0.520 (0.520-0.520)	1.07 (1.07-1.07)	0.058 (0.058-0.058)	0.123 (0.099-0.310)	1.89 (1.87-2.08)
NE level exposure	0.025 (0-0.064)	0.134 (0-0.334)	0	0.014 (0-0.040)	0.087 (0.038-0.310)	0.260 (0.116-0.413)
BDE-209 (ng/d)						
NE level exposure	0.848 (0.302-3.08)	2.49 (0.796-7.03)	0.460 (0-1.22)	0.320 (0.113-0.571)	3.55 (1.49-9.85)	7.67 (4.94-13.8)
∑PBDE (ng/d)						
LB	12.1 (9.31-16.4)	0	0	0.063 (0-0.571)	0.921 (0.425-1.46)	13.1 (10.0-17.5)
MB	12.1 (9.31-16.4)	1.95 (1.95-1.95)	4.01 (4.01-4.01)	0.256 (0.216-0.571)	1.05 (0.737-1.51)	19.4 (16.3-23.8)
UB	12.1 (9.31-16.4)	3.91 (3.91-3.91)	8.02 (8.02-8.02)	0.448 (0.433-0.571)	1.18 (0.993-1.56)	25.7 (22.7-30.1)
NE level exposure	12.1 (9.31-16.4)	1.57 (0.904-2.42)	1.35 (0.737-2.97)	0.207 (0.041-0.571)	1.09 (0.762-1.52)	16.4 (13.5-20.7)
HBCD (ng/d)						
NE level exposure	9.07 (5.07-12.9)	0.723 (0.289-1.15)	0.175 (0-0.921)	0.046 (0-0.168)	0.906 (0.230-1.88)	10.9 (7.37-14.1)

N=9. ∑PBDE=sum of 5 congeners (BDE-47, 99, 100, 153 and 154). NE level exposure=levels below LOQ were not extrapolated, instead the reported levels above the LOD were used. In case of levels below LOD the levels were set to 0. LB=exposure when levels below LOQ were set to 0. MB=exposure when levels below LOQ were set to 1/2 LOQ. UB=exposure when levels below LOQ were set to the LOQ level.

Table 13.5:2. Margin of exposure (MOE) between the per capita exposures to PBDEs in 2010 and the lower-bound 90th percentile benchmark intake corresponding to a 10 % increase in neurodevelopmental effects

Compound	Per capita exposure[a] (ng/kg/d)	BMDL intake[b] (ng/kg/d)	MOE
BDE-47	0.103-0.156	172	1100-1670
BDE-99	0.039-0.070	4.2	60-108
BDE-153	0.011-0.015	9.6	640-870
BDE-209	0.074-0.308	1700000	>100000
HBCD	0.162-0.210	3000	>10000

[a]Body weight 67.2 kg
[b]EFSA (2011) (BMDL=benchmark dose (lower confidence limit)

Table 13.5:3. Mean contribution (range) of the different food groups to the total per capita exposure (medium-bound) of chlorinated pesticides/metabolites, PCBs, PCDD/Fs and brominated flame retardants

Compounds	Fish (%)	Meat (%)	Dairy (%)	Eggs (%)	Fats (%)
BDE-28	86 (77-98)	8.2 (0-15)	3.1 (0-7.3)	0.54 (0-0.93)	2.1 (1.5-3.4)
BDE-47	85 (73-92)	5.1 (0-8.0)	5.9 (2.7-16)	0.42 (0.04-1.8)	3.4 (1.9-5.4)
BDE-99	44 (30-52)	19 (12-32)	18 (9.7-34)	2.7 (0.73-7.9)	17 (13-23)
BDE-100	80 (68-87)	7.8 (4.2-12)	7.5 (5.3-16)	1.2 (0.40-3.9)	3.2 (2.1-5.3)
BDE-153	46 (31-58)	24 (15-39)	11 (0-24)	4.3 (1.3-9.1)	15 (9.6-23)
BDE-154	86 (78-92)	8.7 (4.7-16)	0	1.5 (0-5.0)	4.0 (2.3-6.5)
BDE-183	9.5 (0-26)	49 (0-81)	0	7.0 (0-25)	34 (14-63)
BDE-209	12 (2.6-14)	31 (10-78)	6.2 (0-11)	4.9 (1.4-11)	46 (15-71)
HBCD	82 (69-93)	7.2 (2.3-17)	1.7 (0-7.3)	0.42 (0-1.3)	8.3 (2.6-21)
I-PCB	67 (54-75)	15 (6.7-20)	10 (7.4-20)	4.7 (0.37-28)	2.5 (1.3-4.7)
CB-153	64 (47-74)	15 (5.9-22)	12 (8.1-14)	5.4 (0.28-36)	3.1 (1.6-4.7)
Total TEQ_{2005}	51 (39-64)	17 (8.6-31)	20 (13-30)	3.2 (1.9-5.5)	9.2 (6.6-11)
p,p´-DDE	56 (43-65)	19 (12-28)	15 (12-20)	0.71 (0.16-1.5)	8.9 (4.9-13)
HCB	30 (15-38)	32 (19-57)	29 (23-33)	0.65 (0.25-1.4)	8.9 (3.9-11)

N=5-9

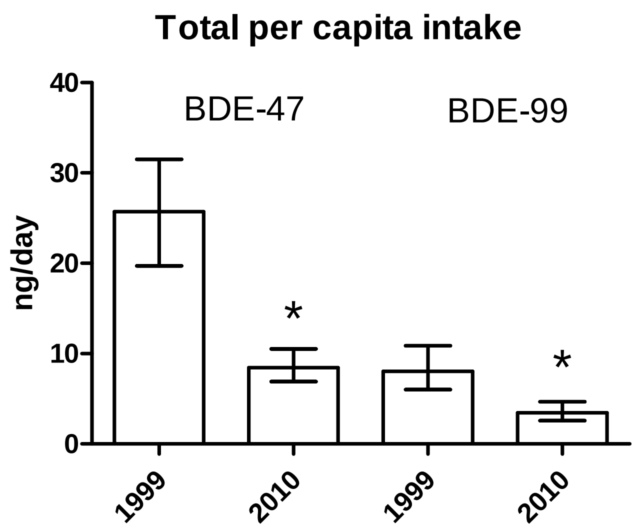

Figure 13.5:1. Total per capita exposure to the PBDE congeners BDE-47 and BDE-99, estimated from the total market basket (mean (range)). The exposures were lower in 2010 than in 1999. (Mann-Whitney U test, $p \leq 0.05$, N=4-9). In 1999 levels of the compounds were above the limit of quantification (LOQ) in the majority of the different food group baskets. In a few cases levels were set to ½ LOQ when levels were below LOQ. In 2010 levels determined to be above the limit of detection were used in cases when levels were below the LOQ.

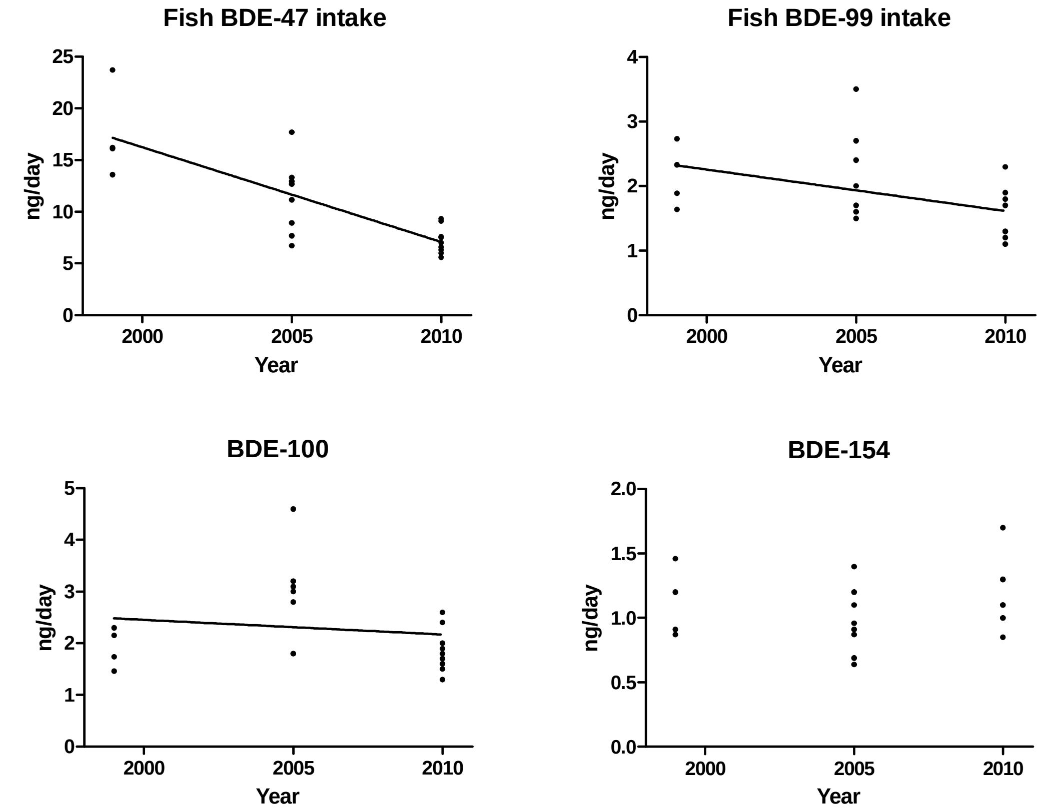

Figure 13.5:2. Per capita exposure to individual PBDE congeners estimated from the fish basket in 1999, 2005 and 2010. Trend for BDE-47, BDE-99 and BDE-100 statistically significant (simple regression analysis, p≤0.05, N=4-9). Levels of the compounds were in all cases above the limit of quantification.

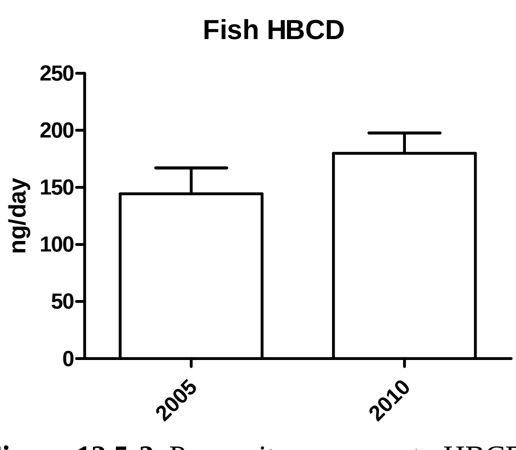

Figure 13.5:3. Per capita exposure to HBCD estimated from the fish basket in 2005 and 2010. No significant difference was seen (Mann-Whitney U test, p>0.05, N=8-9). Levels of the compound were above the limit of quantification in all fish baskets.

Table 13.5:4. Per capita exposure of PCDD/Fs, PCBs and chlorinated pesticides (mean (range))

Compounds	**Fish**	**Meat**	**Dairy products**	**Eggs**	**Fats**	**Total**
∑PCDD/F TEQ (pg/d)						
LB mean (range)	7.40 (3.24-10.6)	2.28 (1.14-7.07)	2.14 (0.683-3.41)	0.726 (0.552-0.921)	0.018 (0.009-0.043)	12.6 (9.30-15.9)
MB	7.63 (4.31-10.6)	2.99 (2.08-7.49)	3.50 (2.69-4.69)	0.956 (0.736-1.17)	2.51 (3.34-2.93)	17.6 (14.8-20.4)
UB	8.05 (5.58-10.6)	3.65 (2.91-7.90)	4.89 (3.92-5.97)	1.19 (1.08-1.63)	5.03 (4.77-5.95)	22.8 (20.5-25.5)
∑dl-PCB TEQ (pg/d)						
LB mean (range)				0.258 (0.012-0.713)	1.02 (0.028-1.55)	21.4 (18.5-24.8)
MB	12.5 (9.12-15.7)	3.56 (1.23-6.86)	4.05 (2.77-5.55)	0.263 (0.032-0.713)	1.05 (0.286-1.55)	21.1 (18.5-24.8)
UB				0.267 (0.051-0.713)	1.08 (0.556-1.55)	21.5 (18.5-24.8)
∑ PCDD/F+PCB-TEQ(pg/d)						
LB mean (range)	19.8 (12.2-26.4)	5.82 (2.91-12.5)	6.20 (3.75-8.96)	0.987 (0.621-1.65)	1.04 (0.040-1.59)	33.9 (28.2-38.4)
MB	20.2 (13.7-26.4)	6.54 (3.53-12.9)	7.68 (5.54-10.7)	1.22 (0.805-1.84)	3.57 (2.74-6.75)	39.2 (33.6-43.3)
UB	20.6 (14.7-26.4)	7.21 (4.37-13.3)	9.01 (7.25-11.9)	1.47 (1.01-2.03)	6.18 (5.56-6.75)	44.5 (39.0-48.6)
∑I-PCB (ng/d)						
LB mean (range)			24.5 (15.2-40.6)	13.3 (0.796-85.5)	5.98 (3.19-10.2)	243 (207-302)
MB	162 (124-190)	37.1 (16.7-76.6)	24.7 (15.8-40.9)	13.3 (0.826-85.5)	6.07 (3.24-10.3)	243 (207-302)
UB			24.9 (16.4-41.1)	13.3 (0.877-85.5)	6.15 (3.29-10.3)	243 (208-302)
CB-153 (ng/d)						
Mean (range)	57.2 (39.7-68.9)	13.4 (5.26-26.8)	10.1 (6.74-17.1)	5.93 (0.260-42.1)	2.68 (1.39-4.61)	89.3 (73.0-117)
∑PCB (ng/d)						
LB mean (range)			38.3 (24.5-62.8)	18.4 (1.29-112)	9.59 (5.65-16.1)	387 (333-467)
MB	265 (203-313)	55.3 (25.6-111)	38.7 (25.4-63.3)	18.4 (1.34-112)	9.71 (5.74-16.2)	387 (333-467)
UB			39.1 (26.2-63.9)	18.4 (1.38-112)	9.82 (5.83-16.3)	388 (334-467)
p,p'-DDE (ng/d)						
LB mean (range)				1.36 (0-2.83)		194 (170-198)
MB	108 (91.7-126)	38.0 (23.7-65.7)	27.4 (17.1-39.7)	1.42 (0.288-2.83)	17.0 (8.66-22.8)	194 (170-198)
UB				1.48 (0.575-2.83)		194 (170-198)
HCB (ng/d)						
Mean (range)	26.4 (24.4-29.9)	35.6 (15.4-95.2)	27.4 (17.1-39.7)	0.575 (0.368-1.17)	7.83 (6.55-8.54)	97.7 (73.0-166)

N=5-9. For details about congeners analysed see 7.3 Analytical methods. ∑PCDD/F TEQ=sum TEQ of 17 PCDD/Fs. ∑dl-PCB=sum TEQ of 12 dl-PCBs. ∑TEQ=sum of 17 PCDD/Fs and 12 ndl-PCBs. ∑PCB=sum of 28 PCB congeners. ∑I-PCB=Sum of 6 ndl-PCBs (indicator PCBs).

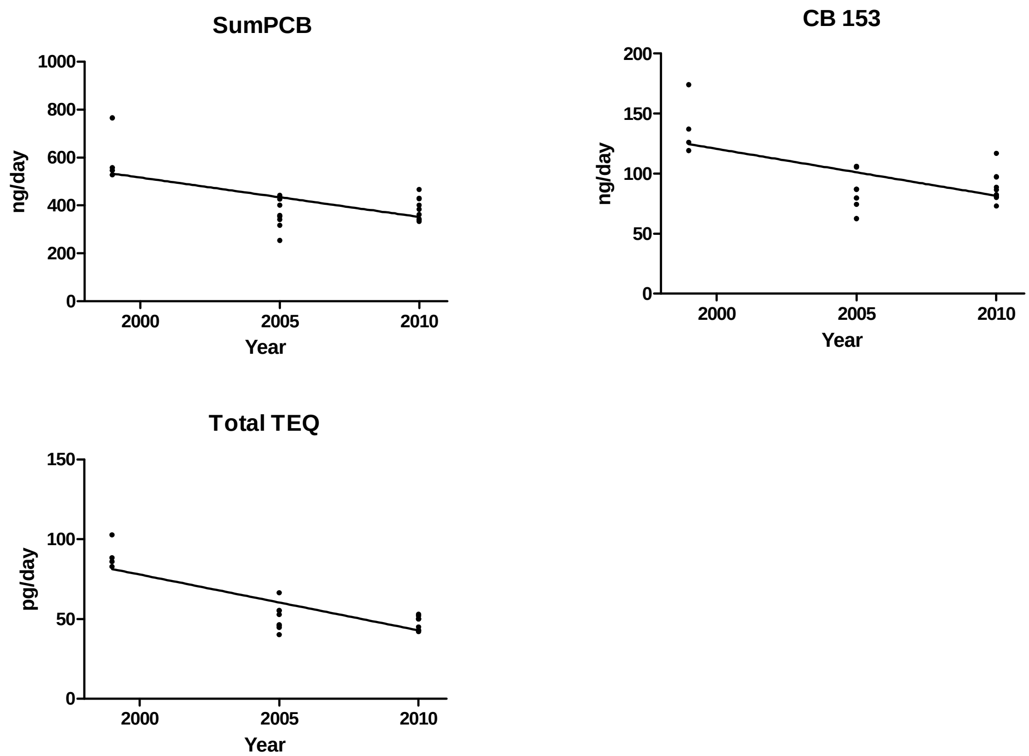

Fig. 13.5:4. Temporal trends of total per capita exposure to PCBs and toxicity equivalents (TEQ) of PCDD/F and dioxin-like PCBs. Trends of ∑PCB (number of congeners 1999:23, 2005:27 , 2010:28), CB-153 and PCDD/F+PCB TEQ (Total TEQ) were statistically significant (simple regression analysis, $p \leq 0.05$, N=4-9). When PCB and PCDD/F levels in the food samples were below the limit of quantification (LOQ) the levels were set to ½ LOQ.

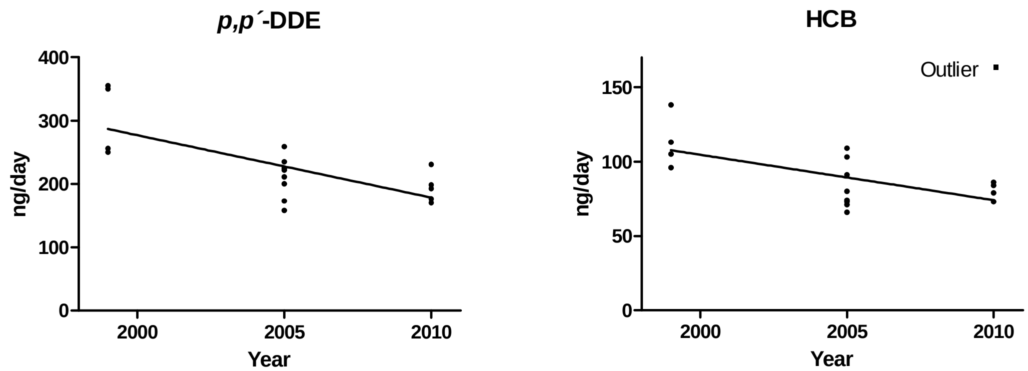

Fig. 13.5:5. Temporal trends of total per capita exposure to individual p,p'-DDE and HCB. Trends for *p,p´*-DDE and HCB statistically significant (simple regression analysis, $p \leq 0.05$, N=4-9). For HCB no significant trend was observed if the outlier in 2010 was included in the regression analysis. In a few cases p,p'-DDE levels were below the LOQ and then the p,p´-DDE level was set to ½ LOQ.

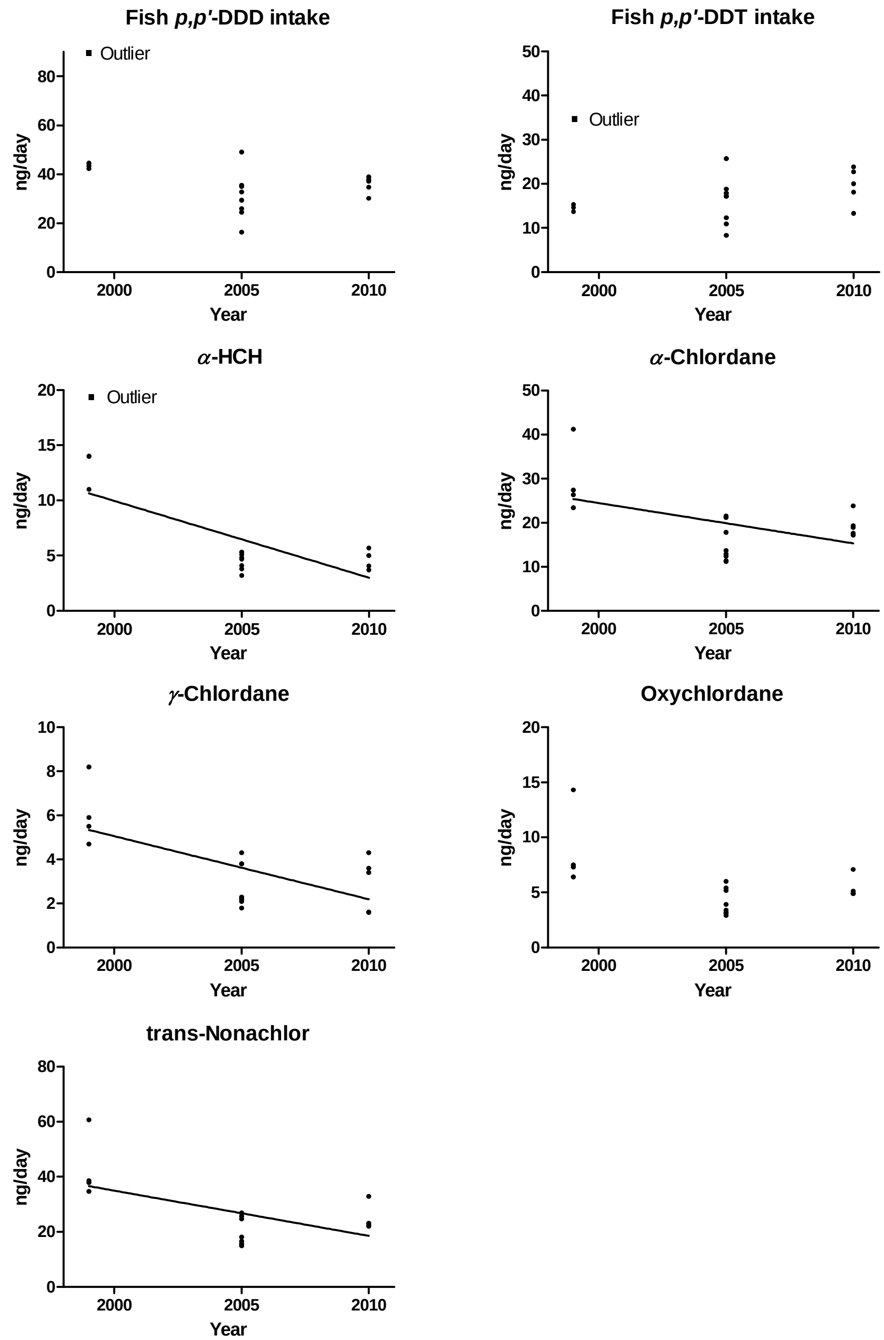

Fig. 13.5:6. Per capita exposure to individual chlorinated pesticides/metabolites estimated from the fish group samples. Trends for α-HCH (with and without outlier), α-chlordane, γ-chlordane, and trans-nonachlor were statistically significant (simple regression analysis, $p \leq 0.05$, N=4-9). Levels of the compounds were above the limit of quantification (LOQ) in fish samples from all baskets.

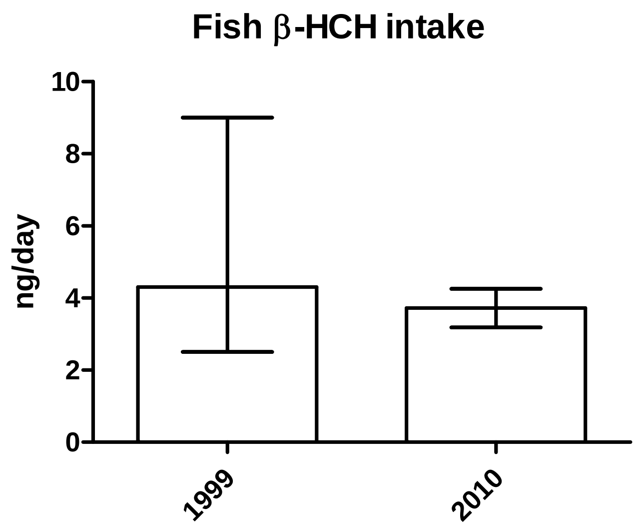

Fig. 13.5:7. Per capita exposure to β-HCH estimated from the fish group samples (mean, range). No significant difference in levels was observed (Mann-Whitney U test, $p \leq 0.05$, N=4-9). Levels of the compounds were above the limit of quantification (LOQ) in fish samples from almost all baskets. In the few cases when levels were <LOQ the levels were set to ½ LOQ.

13.6 Pesticides

13.6.1 General about pesticides

The quality and yield of agricultural and horticultural crops is jeopardised by plant diseases and infestation by pests. Therefore, pesticides are often used to protect crops before and after harvest. For example, herbicides, fungicides or insecticides may be used, depending on which organisms need to be controlled. A possible consequence of their use may be the presence of pesticide residues in the treated products. Pesticide residues are the measurable amounts of the active substances used in plant protection products, their metabolites and/or breakdown or reaction products resulting from the use of plant protection products.

It is necessary to ensure that such residues are not found in food or feed at levels presenting an unacceptable risk to humans. Maximum residue levels (MRLs) are therefore set by the European Commission to protect consumers from exposure to unacceptable levels of pesticides residues in food and feed.

MRLs for pesticides are defined as the upper legal levels of a concentration for a pesticide residue (expressed in mg/kg) in or on food or feed in accordance with Regulation (EC) No 396/2005. MRLs are derived by statistical calculations based on supervised field trials and are set at a level which should ensure that residues in the harvested crop do not exceed the legal limits if the crop has been produced according to the authorised Good Agricultural Practice (GAP).

MRLs are not primarily toxicological safety limits, but reflect the use of minimum quantities of pesticides to achieve effective plant protection, applied in such a manner that the amount of residue is the smallest practicable and set at levels where a consumer health risk is not expected. Therefore, before an MRL is established, a risk assessment has to prove that the limit is safe for consumer health, including the most vulnerable groups (e.g. children and pregnant women). In most cases the MRLs are set well below the toxicologically acceptable residue levels.

In Sweden, the National Food Agency monitors pesticide residues in food. These samples are taken from individual food commodities, for example apples, oranges, cereal grains, tomatoes and potatoes. The measured residues are compared with MRLs for a specific pesticide in a specific commodity. In the monitoring of pesticide residues in fruits and vegetables in 2010, in 34 % of the samples no residues were detected, in 61 % of the samples levels below the MRLs were found, and in 5 % of the samples, the established MRLs were exceeded (Wannberg et al., 2012). In the market basket approach, pesticide residues that could occur in individual commodities are diluted and the levels are therefore lower when analysed in whole food groups compared to in individual samples (see also information about analytical methods in 12.4). Still, the current study gives an estimate of the chronic exposure to pesticide residues from food in the general population in Sweden, and is an important complement to the monitoring of pesticide residues. However, in this type of study it is not possible to make any estimation of the acute intake, in case a person eats for example a fruit with a high level of pesticide residues.

13.6.2 Occurrence and exposure to pesticide residues

Of the almost 400 pesticide analytes included in the analytical method, a total of ten different pesticides were detected in the two food groups vegetables and fruits (Table 13.6:1). The detected pesticides included seven fungicides, two insecticides and one plant growth regulator (diphenylamine). Diphenylamine is currently not approved for use in the EU. The occurrence in this sample may be due to contamination, unapproved use within the EU or residues in a crop imported from a third country (outside EU). It is not possible to determine the origin, and since the detected residue level was below the LOQ (0.02 mg/kg) this is not considered important. In general, the residue levels were low (in many cases below the LOQ) and thus the exposures to pesticide residues were estimated to be low. No residues were detected in cereal products, potatoes and meat and therefore there was no or only insignificant contribution to the pesticide exposure from these food groups.

Pesticides are a very diverse group of chemicals, with different toxic properties and effects and the exposure to each substance has to be compared with its respecttive acceptable daily intake (ADI), which has normally been established by the EU Commission. Potential combination effects are not expected to play a significant role, e.g. because of the low levels found in this study, and it was not considered relevant to sum up the exposure to residues of different pesticides to estimate a total exposure. To calculate the exposure and risk for adults, the mean body weight of all consumers, 67.2 kg, was used (cf. chapter 10). Children may be more susceptible to exposure to pesticide residues compared to adults, because of a higher bodyweight-based food consumption, in many cases more selective eating habits, and, not least, the ongoing developmental changes (e.g. brain, hormonal systems) that occur during childhood. Due to lack of consumption data among young children the average per capita consumption of vegetables and fruits (0.70 kg/d and 0.87 kg/d, respectively) was used to estimate the exposure also for children. As a worst case, a body weight of 15 kg was assumed for a child of 2-3 years age, i.e. the age when a child is expected to start eating more regular food, instead of baby food. This gives an overestimation of the residue exposure and risk, since small children are not expected to eat as much as adults.

In vegetables only two different fungicides, propamocarb and pyrimethanil, were detected and at low concentrations (for pyrimethanil below the LOQ of 0.01 mg/kg) in five of the samples and the two compounds were not found in the same food basket (Table 13.6:1, Annex I). Thus, the residue exposure from vegetables was low, ranging from 0.2-9.1 µg/day, with the highest exposure to propamocarb.

This exposure corresponded at the most to 0.21 % of the ADI for propamocarb in children and 0.05 % of the ADI for adults.
In fruits, residues of nine different pesticides were detected in total, with one to five different pesticides found in the same sample (Table 13.6:1,Annex I). The most frequently detected pesticides in fruits were thiabendazole and imazalil, which were both present in eight of the 14 samples. These two fungicides are used for post-harvest treatment of fruits and were commonly detected in samples of citrus fruit (imazalil and thiabendazole), and apples and pears (thiabendazole) in the Swedish monitoring programme in 2009 and 2010 (Jansson et al. 2011, Wannberg et al., 2012). The third most common pesticide to be detected was boscalid, which was detected in four of the fruit samples. This fungicide is frequently found in samples of table grapes, strawberries and pome fruit, when monitoring pesticide residues (e.g. Jansson et al. 2011). Since these above mentioned fruits were included in the mix of fruits, it is not surprising to find low levels of these pesticides in the pooled samples.

Table 13.6:1. The pesticide residues detected in fruit and vegetables, their respective ADI-values and the highest estimated intakes. Exposures presented in italics were calculated based on concentrations below the LOQ

Detected pesticide	**ADI-value[1] (mg/kg bw/d)**	**Highest estimated exposure (mg/day)**	**Highest exposure (% of ADI)**	
			adult	**children**
Boscalid	0.04	0.004	0.15	0.67
Diphenylamine	0.075	*0.002*	*0.01*	*0.04*
Fenhexamid	0.2	0.004	0.03	0.13
Fludioxonil	0.37	0.006	0.02	0.11
Imazalil	0.025	0.009	0.51	2.28
Phosmet oxon	0.01	*0.003*	*0.39*	*1.74*
Pirimicarb	0.035	0.004	0.16	0.72
Propamocarb	0.29	0.009	0.05	0.21
Pyrimethanil	0.17	0.003	0.03	0.10
Thiabendazole	0.1	0.024	0.35	1.57

[1] ADI values taken from the EU pesticides database, http://ec.europa.eu/sanco_pesticides/public/index.cfm

Considering the low concentrations of residues in the samples, the highest exposure, 23.5 µg thiabendazole/day, was also low and was from a fruit sample where residues of imazalil was also detected. When the estimated exposures were compared with the ADIs for these pesticides, the highest exposure was 2.3 and 0.5 % of the ADI for imazalil for children and adults, respectively (Table 13.6:1). The highest exposure to thiabendazole was 1.6 % of the ADI for children and 0.4 % of the ADI for adults. Phosmet oxon, which is a metabolite of the organothiophosphate insecticide phosmet, was detected in one fruit sample at a concentration which was below the LOQ (0.05 mg/kg) (Table 13.6:1). The measured concentration was therefore not validated, but if it is used for an exposure estimation it would correspond to an intake of at the most 1.7 % of the ADI for children and 0.39 % of the ADI for adults.

13.6.3 Differences in pesticide residues between baskets

One purpose of the study was to compare the content of pesticide residues in vegetables and fruits sampled in spring and autumn. The idea was that at autumn, there would be more locally produced (Swedish) vegetables and fruits compared to the spring samples and therefore a possible difference regarding pesticide residues. However, this did not seem to be the case. In vegetables there were too few findings to be able to make comparisons between baskets. In fruits, no difference was observed in the mean number of pesticides detected or their levels in the baskets (Table 13.6:2). One likely reason for this finding could be that the main contributors to the pesticide residues in the fruit slurries were imported fruits, pears, oranges, grapes, banana, melon and kiwi, which were the same in both spring and autumn samples. Another aim of this study was to look for possible differences between the standard and low-price baskets. With regard to pesticide residues, there were no clear differences in the number or levels between the standard and low-price baskets. It should be kept in mind though, that the overall occurrence of pesticide residues was very low, and therefore it was not considered relevant to make statistical analyses and comparisons.

Table 13.6:2. Mean number of pesticides detected and estimated highest exposures in fruits from different baskets

Fruit sample	Mean number of pesticides detected (number ± st dev)	Highest exposure in % of ADI, children	Highest exposure in % of ADI, adults
Standard price	2.0 ± 0.81	1.7	0.42
Low price	2.6 ± 1.5	1.1	0.28
Standard price, Autumn	2.2 ± 0.45	2.3	0.55

13.6.4 Conclusions

In the market baskets investigated, the number of pesticides and the levels found were low, and residues were only detected in the two groups vegetables and fruits. All the estimated chronic exposures to pesticide residues were well below the respective ADIs. Additionally, the low residue exposures, and the relatively few pesticides found with levels above LOD, imply that no cumulative or mixture toxicity effects from the different pesticides are expected to occur. Therefore, it is concluded that the pesticide residues observed in this market basket study, do not indicate any chronic consumer health concern in the Swedish general population. With regard to the acute risk, it is not possible to draw any conclusions, since there is no information about the pesticide residue levels in single fruits that one person may be exposed to.

13.7 Polycyclic aromatic hydrocarbons (PAHs)

13.7.1 Health effects of Benzo(a)pyrene

The main concern regarding possible health effects of Benzo(a)pyrene (BaP) is its carcinogenicity (DNA-damaging effect). It causes tumors in laboratory mammals. BaP is classified by the WHO organ IARC (International Agency Research on Cancer) as a human carcinogen and by an ”overall evaluation upgraded to Group 1 based on mechanistic and other relevant data” it is therefore assumed that there is no dose level without any increased health effect. This is the reason why no tolerable dose (TDI) can be postulated. On the contrary a lowering of the exposure is always a lowering of the risk of tumor incidence. BaP and the other PAH compounds included in the 4PAH group (benz(a)antracene, chrysene, benzo(b)fluoranthene, and BaP) are classified as genotoxic (EFSA 2008b).

13.7.2 Estimated PAH intake and discussion

Analysis of the PAH content in the twelve different food groups included in the Market Basket 2010 survey, showed that the total per capita exposure to BaP for the Swedish population is estimated to about 33 ng/person and day, corresponding to 0.5 ng/kg b.w. and day (assuming a body weight of 67 kg). The analysis of samples collected in the market basket study ten years earlier (1999) shows that the mean exposure to BaP was somewhat higher at that time, 40 ng/person and day, corresponding to 0.6 ng/kg b.w.and day, Table 13.7:1. At the same time as the analysis of the concentration of BaP was made the sum of the concentration of four polycyclic aromatic hydrocarbons, PAH4, was also measured. In 1999 the mean exposure to PAH4 was calculated to 273 ng/person and day (4.1 ng/kg b.w. and day) and at present (2010) the same type of calculation results in a mean exposure to 239 ng/person and day (3.6 ng/kg b.w. and day), Table 13.7:1. Some of the food groups belonging to the Market Basket collected in 1999 and 2010 were not analysed for BaP and consequently no data of PAH4 from the same food groups are available. The reason behind the lack of analyses for these food groups is that levels below the detection limit were expected in these cases (based on earlier analyses made at NFA, oral communication). This has been taken into consideration when the comparison between results from the market baskets of 1999 and 2010 was made.

Table 13.7:1. Exposure to BaP and PAH4 in the Swedish population 1999 and 2010

Food group	consumption ($g \cdot 10^2$/year)	consumption (g/day)	BaP (µg/kg food)	BaP exposure (ng/person and day)	PAH4 (µg/kg food)	PAH4 exposure (ng/person and day)
1999						
Cereal pr.	694	190	0.06	11.4	0.37	70.3
Pastries	137	38	0.22	8.4	1.61	61.2
Meat	567	155	0.04	6.2	0.3	46.5
Fish	133	36	n.a.	0	n.a.	0
Dairy pr.	1685	462	n.a.	0	n.a.	0
Eggs	92	25	n.a.	0	n.a.	0
Fats	175	48	0.13	6.2	0.78	37.4
Vegetables	548	150	n.d.	0	n.d.	0
Fruits	641	176	n.d.	0	0.1	17.6
Potatoes	514	141	n.d.	0	n.a.	0
Sugar,etc.	354	97	0.08	7.8	0.41	39.8
Beverages	1188	325	n.a.	0	n.a.	0
Total				*40*		*273*
2010						
Cereal pr.	844	231	0.03	6.9	0.14	32.3
Pastries	185	51	0.05	2.6	0.28	14.3
Meat	759	208	0.03	6.24	0.27	56.2
Fish	185	51	n.d.	0	0.09	4.6
Dairy pr.	1557	427	n.d.	0	n.d.	0
Eggs	84	23	n.d.	0	0.06	1.4
Fats	145	40	0.12	4.8	0.62	24.8
Vegetables	704	193	n.d.	0	0.05	9.6
Fruits	867	238	n.d.	0	0.10	23.8
Potatoes	458	125	n.d.	0	0.03	3.8
Sugar, etc.	453	124	0.1	12.4	0.55	68.2
Beverages	1205	330	n.d.	0	n.d.	0
Total				*33*		*239*

n.d. = not detected
n.a. = not analysed

Two major factors determine the actual intake of a compound via the food, i.e. the amount and type of food consumed and the levels in food of the compound. In the comparison of 1999 and 2010 market basket results regarding PAH exposure, it should be noted that the estimated per capita consumption of most food groups was somewhat lower in 1999 compared to 2010 (Table 13.7:1). Concerning the sensitivity of the analysis, the analysis of PAHs was made at the same occasion for the 1999 and 2010 market basket studies, 1999 and 2010. Analysis at the same occasion is an advantage when comparisons between samples from different studies are made, especially if the sensitivity of the methods of analysis used has changed during the period between the two sampling occasions. Specifically, the PAH content in pastries was clearly higher in 999 compared to 2010, which most likely contributed to a lowering of the total exposure in 2010.

When comparing the BaP content in the different food groups this shows that fats and pastries have the highest levels, Table 13.7:1. Due to both altered levels in food groups and changed food habits, cereals gave the highest exposure, 28 % of the total intake in 1999, whereas the main contribution in 2010, 38 %, came from the food group sugar and sweets (Fig. 13.7:1a,b).

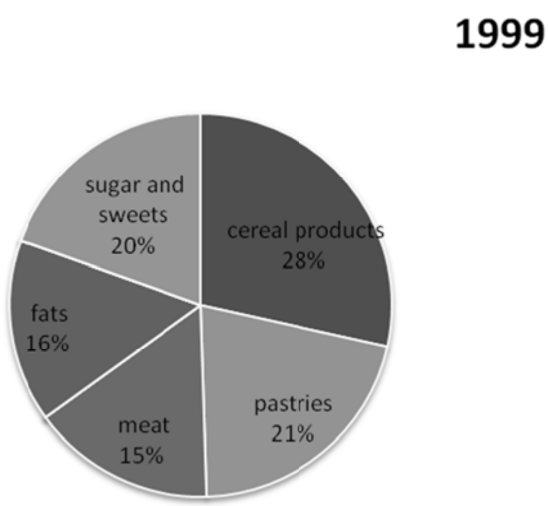

Fig 13.7:1a. The proportion of the mean exposure to BaP, ng/person and day, in some of the different food groups from Market Basket 1999.

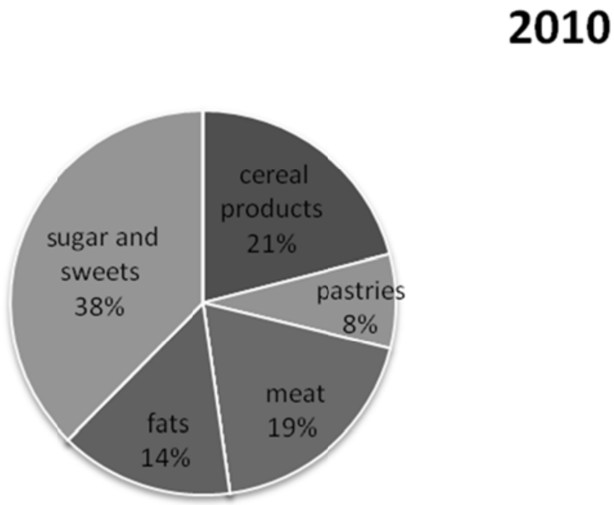

Fig 13.7:1b. The proportion of the mean exposure to BaP, ng/person and day, in some of the different food groups from Market Basket 2010.

The calculated total average exposure to BaP for the Swedish population is reasonably low. Compared to the calculated intake made by EFSA 2008 (EFSA, 2008b), the exposure level in our study is almost ten times lower and the main reason for the difference is the lower PAH levels found in Swedish food samples. In both the present study and the EFSA report, cereal products contribute with a substantial part of the BaP intake. The Food Safety Authority of Ireland has recently published a report on a total diet study for the period 2001-2005 (FSAI, 2011). They calculated the intake of 11 different PAHs and concluded that also the intake in Ireland is also substantially lower than the calculated intake made by EFSA 2008. Twelve years ago the BaP intake was estimated in Sweden (NFA 1998). This calculation showed an intake of 30 µg/person and year, i.e. 0.1 µg/person and day, or about 1 ng/kg b.w. and day, which is higher than what was estimated from this study (0.5 ng/kg b.w. and day). One of the reasons behind the differences in exposure is the sensitivity of analytical methods. Previously the limit of detection was about 0.1 µg/kg for cereals, but today the sensitivity of analytical methods is higher, 0.03 µg/kg, which in turn has an impact on the exposure calculations.

In this report we also present the concentration and exposure to the sum of four different PAHs, PAH4. This is because work is currently ongoing in the EU to set new maximum levels for BaP in food, alone as well as to include the sum PAH4. PAHs occur in complex mixtures which may consist of hundreds of compounds. Among all these compounds a total of 16 different PAHs have been identified and classified as genotoxic compounds and some of them also as carcinogenic (see chapter 12.5). The four compounds, PAH4, benz(a)antracene, BaP, benzo(b)fluor-anthene, and chrysene are all classified as genotoxic carcinogenic compounds and can be used as a suitable marker of exposure and effect (EFSA 2008b).

Cooking behaviour may likely contribute to the exposure to PAHs. In the Market Basket collected and analysed in this investigation no barbequed foodstuffs are included. Assuming that an average Swede barbecues every second week during the summer period (three months), this might result in an exposure of about a third of the total contribution from all other foods. In such an example we have calculated with an average BaP level of 5 µg/kg meat and a portion size of 150 g. This assumption is based on earlier studies where barbequed foodstuffs have been analysed, e.g. Alomirah and co-workers report mean BaP level in barbequed meat of about 2 µg/kg (Alomirah et al 2011). Data evaluated by IARC postulated that grilled meat in general is estimated to contain 10.5 µg/kg BaP (IARC, 1993).

Since BaP is classified as a genotoxic carcinogen it is possible to calculate the lifetime cancer risk for humans. From the incidence of tumors reported from the cancer studies in rodents it is assumed that the lifetime cancer risk is about $0.8 * 10^{-3}$ when the intake of BaP is 1µg/kg b.w. and day. Here in this study we calculated the BaP exposure to 0,5 ng/kg b.w. and day, which in turn points to a risk of $0.4 * 10^{-6}$. This calculated lifetime cancer risk applied on the Swedish population, about ten millions, implies a cancer incidence of about four persons /year.

13.7.3 Conclusions

The calculated exposure to BaP from the Market Basket points to a reduction during the last ten years, indicating a reduced cancer risk. At the same time, if the barbequing is made in an improper way, resulting in high PAH levels in food, this may substantially contribute to the total health risk.

14. General discussion

The market basket studies performed by the NFA present estimates of the per capita exposure based on Swedish food production and trade statistics, and population statistics. Thus, the resulting figures show the average amounts of a number of studied substances, both nutrients and toxic compounds, which are found in foods available for consumption. The market basket method gives the opportunity to study a large number of analytes in one common study, and has other advantages as well as limitations that are discussed in greater detail below. The presented data could be used as a base for risk, or benefit, assessments of the mentioned compounds on a population basis, but have less value for more specialised (sensitive groups, high-low consumers etc.) exposure calculations because of lack of individual consumption data. It should be stressed that the present report is a first, general presentation of all the data generated within this project, and that further and more in-depth presentations of certain parts of the project are expected to follow later.

Data from the present Market Basket 2010 show that the per capita exposure to nutrients and minerals seems to be rather similar compared to earlier studies, with no major changes seen. The per capita supply of total fat (116 g/person and day) was somewhat higher than in an earlier (2005) market basket study (perhaps due to an increase in per capita supply of fatty food items in the sugar and sweets group), and the contribution of various types of fatty acids to total amount of fatty acids was similar as in the 2005 study (at present, saturated fatty acids contribute with 14 E%). Notably, the average exposure to starch and dietary fibre was lower, whereas the exposure to sucrose was higher, than in 2005. However, the calculated per capita exposure of added sugars was 113 g/person and day, equal to 15 E%, similar to that found in 2005. This is higher than what is recommended by the Nordic Nutritional Recommendations (NNR), whereas the fibre intake (1.7 g/MJ) is lower than recommended, based on an estimated energy content of the market baskets of 12.5 MJ/person and day. The supplies of most essential minerals were close to or above recommended intakes of reference values.

An overview of the situation regarding estimated intakes of potentially toxic compounds, based on market basket per capita exposure values, shows that the average consumer is exposed to most of the studied compounds in low levels that, based on current knowledge, are acceptable from a health risk point of view. Moreover, in cases where time trends could be studied, the levels were generally decreasing for organic compounds such as persistent organc pollutants (POPs) and polycyclic aromatic hydrocarbons (PAHs), whereas the trends were less clear for toxic metals. In the case of POPs, the decrease in per capita exposure was most pronounced between the 1999 and 2005 market basket studies, and less marked for 2005-2010 (e.g. PCBs and PCDD/Fs). In certain cases, per capita exposure to some POP compounds has not changed (BDE-154, HBCD-fish). Regarding the metals, the lack of decrease in per capita exposure to lead when comparing the 1999 and the present Market Basket studies should be noted. Also, the uncertainties about the arsenic exposure and what it represents (organic-inorganic forms) could be mentioned. The per capita exposure to pesticide residues, studied for the first time with market basket methods, could be estimated for the 10 pesticides detected out of approx. 400 pesticides that were analysed for by multianalysis technique. These 10 pesticides were found in low levels and estimated worst case exposures (children) were only at percentage levels of the acceptacle daily intake (ADI), and the low or mostly non-detected levels also imply that cumulative, or mixture, effects of different pesticides are not probable. However, acute risks as a consequence of high consumption of a special batch of highly contaminated vegetables or fruits could not be assessed in the present type of market basket study. Finally, estimated the PAH per capita exposure was reduced in this study compared to the 1999 Market Basket study, which would also imply a decrease in the theoretical cancer risk from PAHs, as compounds in this groups are suggested to be carcinogenic without a threshold.

The assessment does not account for variability in exposure between individuals. Exposures that impose health risk concerns may potentially be present for parts of the population (e.g. for high consumers, and children) and this aspect can be of relevance for most of the toxic compounds analysed. An improvement when utilizing market basket data may be to extend the consumption scenarios used so that variability in consumption is better accounted for. This is expected to improve the resolution regarding the assessment of the general exposure from basic food groups.

As stated above, the average pesticide residue exposure data most likely do not suggest combination effects because of the low, or absence, of detectable levels of most pesticide compounds included in the analytical multi-method (having reasonably low detection limits). However, combination effects may still be of relevance in the risk assessment of the studied compounds in our market baskets in combination with the large number of substances simultaneously present in our food. Within certain areas, combinations effects are already dealt with from a risk assessment point of view (dioxins, some pesticides) and recent activities may increase our knowledge within this area (e.g. EFSA, 2009c). One type of biological effect that may be relevant in a “cocktail” point of view is the disruption of hormonal systems, an effect that have been observed for many different chemical compounds in various experimental test systems. As this type of effect is not generally included in standardized test guidelines for experimental data generation, and thus some effects may be overlooked in the risk assessment process. Also, in epidemiological studies various effects, including hormonal effects, are suggested at lower exposure levels than those obtained from experimental studies on animals. If these epidemiological studies were to be included in the generation of regulatory reference values, safety margins between current background exposures and reference levels would in many cases decrease or even disappear.

The present market basket study aimed to purchase both standard and low price food items, in order to look for possible differences between these two classes of food. In general, no data were obtained hat could point to a general difference between the food classes, and when differences were seen, there were no general trends. For some of our analysed data (POPs, pesticides, metals), we could also study potential differences between the grocery chains, as analyses were done on separate market baskets from these various chains. In those cases, no marked differences were observed between grocery chains, and no further presentation on these aspects were made. However, in these case, as well as regarding the lack of consistent differences between spring and autumn food samples (vegetables, fruits and potatoes), further analyses of the data material may find trends or differences not obvious in this primary report.

The per capita exposure to nutrients and toxic compounds could be influenced both by the analysed levels of compounds found in the food samples and by the per capita consumption as registered by the SBA production and trade statistics. Indeed, a change in per capita consumption over time could as such result in changes in per capita exposure, and changes in per capita consumption have been mentioned in sections concerning the calculated exposures to POPs and PAHs. When comparing the present consumption figures with those used in the two earlier market basket studies in 1999 and 2005 (Darnerud et al., 2006; Törnkvist et al., 2011) we observe changes (in both directions) in the per capita consumption of the different food groups. Thus, compared to the 1999 study, the present per capita consumption has increased for meat (+ 34 %), fish (+ 39 %), vegetables (+ 21 %) and fruits (+ 35 %), whereas a decrease was seen for potatoes (- 11 %) and fats (- 17 %). In case of the latter figure for fats, it should not be interpreted as a total decrease in fat consumption, as fat is part of several other food groups. Indeed, the calculated exposure to total fat from the present market basket was higher compared to the study in 2005. In any case, it is important to consider possible changes in per capita consumption over time, as these changes could be part in the explanation of variations and trends in per capita exposure to the studied components and compounds.

The market basket per capita exposure figures are approximate estimations of the "real" exposures, and have several limitations. First, the per capita statistics refer to amounts available for consumption in the retail and catering sector. Food wastage occurs in shops and private house holds, which are not taken into consideration in the market basket study. It is estimated that 10-20 % by weight of our total food purchase is not consumed mainly because of food becoming inedible due to too long storage time or inappropriate storage conditions (NFA, 2011). Second, some food items or categories contain parts that will not be consumed, for instance bones, rind, peels, pips etc. To a certain extent, this has been compensated for in our study by a percentage reduction in the weight of listed food items, e.g. beef containing bone, pork chops, chicken, whole fish, shellfish, many vegetables (see Annex A). Third, food produced and consumed locally will not be fully accounted for in the food statistics. Private vegetable, potato and fruit production, berry- and mushroom picking, and private fishing and hunting will constitute a considerable part of the total food consumed for certain sections of the population. Four, it should be noted that food generally eaten more seldom is not part of the market basket approach. Five, tap water, coffee, tea, and alcoholic beverages were not included in the baskets, which may have an impact on the total exposure estimates for some substances among individuals or specific groups. Six, for some compounds the contribution of contamination from food packaging materials not monitored by our methods, may be of importance to study (e.g. used within the fast-food industry). Seven, the chemical analyses were made on homogenates containing food items as purchased, not as consumed (cooking etc. may alter certain levels). To conclude, the mentioned limitations, in addition to other potential errors and shortcomings in the production and trade statistics, will result in uncertainties around the per capita exposure values and may thus result in both underestimations and, more likely, overestimations of the actual mean population consumption estimate.

In spite of the limitations mentioned above, the market basket approach, as it has been used in the present study, has several advantages that make it a useful method for many purposes. It is a relatively simple and robust method for obtaining a rough estimate of the mean exposure of e.g. nutrients and toxic compounds from the total diet for the general population. The analyses of whole food groups will limit the number of analyses and therefore decrease analytical costs. Moreover, as the methods are more or less similar from time to time, the method is useful for studying trends, as could be exemplified in our study of temporal POP trends. In addition, the method is convenient to use when we want to study new, hitherto unknown substances, and their presence in our food and their mean exposures. Also, as samples of market baskets are stored at -20 ºC, future analyses of new substances could also include older, banked samples from earlier studies. Finally, market basket data could be used in validation of other methods for exposure estimations, and differences in results between market basket and other methods can be discussed in the light of what we know about sources of errors with the different methods.

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16. List of annexes

Market basket shopping list	Annex	A
Population body weight calculation		B
Concentrations of trans fatty acids		C
Concentrations of individual fatty acids		D
Concentrations of mineral elements/metals		E
Concentratins of persistent organic pollutants (POPs)		F
Analytical flow schemes: vegetables, cereals, meat		G
Pesticide multimethod, detectable analytes		H
Concentration of found pesticides (fruit and veg.)		I
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Average per capita exposure of fatty acids		K

Annex A - Provtagningslista för Matkorgen 2010

Nr No	grp grp	Utvalt livsmedel (viktningsfaktor i procent)	Selected food item (Weighting factors, %)	Kommentar Comment	kg/L/år kg/L/yr	Inköpsmgd. Purchase qnt.	Provmgd., g Sample qnt., g	Avfall % Waste %	Invägd mängd, g Weighed qnt., g
1	1	Vetemjöl	Wheat flour		6,9	1 pkt	69	0	69
3	1	Rågsikt	Sifted rye flour		0,5	1 pkt	5	0	5
4	1	Risgryn	Polished rice		5,6	1 pkt	56	0	56
5	1	Havregryn	Rolled oats		3,4	1 pkt	34	0	34
8	1	Vällingpulver, vuxen	Gruel powder		0,8	1 pkt	8	0	8
9	1	Spaghetti/makaroner	Spaghetti/macaroni		9,7	1 pkt	97	0	97
10	1	Corn Flakes	Corn Flakes		3,7	1 pkt	37	0	37
12	1	Rågknäcke	Crisp bread, rye		3,5	1 pkt	35	0	35
14	1	Franskbröd (40%)	White bread (40%)	lokalt bageri	50,3	1 bröd	201	0	201
14	1	Rågsiktsbröd, limpa (40%)	Bread, sifted rye (40%)	lokalt bageri	50,3	1 bröd	201	0	201
14	1	Grovt rågbröd (20%)	Rye bread (20%)	lokalt bageri	50,3	1 bröd	101	0	101
									844
15	2	Småkakor	Bisquits	1 påse blandade	5	300g	50	0	50
16	2	Vetebröd (80%)	Rolls (80%)	vetelängd, lokalt bageri	3,9	1 längd	31	0	31
16	2	Wienerbröd (20%)	Danish pastery (20%)	lokalt bageri	3,9	3 st	8	0	8
17	2	Konditoribitar (70%)	Pasteries (70%)	arraksboll, mazarin etc.	9,6	3 st/sort	67	0	67
17	2	Pizza etc. (30%)	Pizza etc. (30%)	pizza (15%), pirog (15%)	9,6	2 st/sort	29	0	29
									185
22	3	Nötkött, innanl. u ben	Beef, sirloin		9,9	300g	99	10	89
23	3	Fläskkotlett	Pork chop		15,2	½ kg	152	15	129
24	3	Lammkotlett/bog	Lamb chop		1	300g	10	30	7
25	3	Kyckling, fryst	Chicken, frozen		14,9	1 st	149	32	101
27	3	Älgskav, fryst	Moose (thinly sliced)		1,7	1 pkt	17	0	17
30	3	Skinka rökt (76%)	Smoked ham		4,5	300g	34	0	34
30	3	Bacon (24%)	Bacon		4,5	1 pkt	11	0	11
31	3	Falukorv (38%)	Sausage, "Falu-type" (38%)	lokal producent	19,9	300g	76	0	76
31	3	Varmkorv (33%)	Frankfurter (33%)	lokal producent	19,9	300g	66	0	66
31	3	Leverpastej (18%)	Liver pate (wurst) (18%)	bredbar	19,9	200g	36	0	36
31	3	Medvurst, rökt (11 %)	Ger. sausage (cold c.)(11%)		19,9	200g	22	0	22
34	3	Köttsoppa på burk	Meat soup (canned)		0,6	1 burk	6	0	6
36	3	Hamburgare, frysta (60%)	Hamb. patties (frozen)(60%)		16,5	1 pkt	99	0	99
36	3	Kåldolmar, frysta (24%)	Stuffed cabbage roll (24%)		16,5	1 pkt	40	0	40

36	3	Pyttipanna, fryst (16%)	Swedish hash		16,5	1 pkt	26	0	26
									759
38	4	Rödspätta filé, färsk	Plaice , filet, fresh	fryst om saknas	0,6	200g	6	0	6
39	4	Torskfilé, färsk	Cod, filet, fresh	fryst om saknas	0,6	200g	6	0	6
40	4	Strömming/sill, färsk, filé	Herring, filet, fresh	fryst om saknas	1,1	300g	11	10	10
41	4	Lax, färsk, filé/sida	Salmon, filet fresh	fryst om saknas	2,0	300g	20	10	18
43	4	Gädda, abborre, färsk (hel)	Pike, perch, fresh (whole)		1,0	1-3 st	10	50	5
45	4	Rödspätta filé, fryst	Plaice , filet, frozen		3,8	1 pkt	6	0	6
46	4	Torskfilé, fryst	Cod, filet, frozen		3,8	1 pkt	17	0	17
47	4	Makrillfilé, fryst	Mackerel, filet, frozen		3,8	1 pkt	15	0	15
49-51	4	Rökt fisk, makrill/lax	Smoked mackerel/salmon		1,3	300g	13	20	10
52	4	Smörgåskaviar	Swe. caviar (bread spread)		2,0	1 tub	20	0	20
53	4	Inlagd sill	Pickled herring	löksill el liknande	2,0	1 burk	20	50	10
54	4	Tonfisk i olja på burk	Canned tuna, in oil		1,3	1 burk	13	0	13
55-56	4	Fiskbullar i sås,burk (50%)	Fish quernelles, can (50%)		2,9	1 burk	15	0	15
55-56	4	Fiskpinnar, frysta (50%)	Fish fingers, frozen (50%)		2,9	1 pkt	15	0	15
58	4	Räkor oskalade, frysta	Shrimp, unpeeled frozen		1,5	200g	15	62	6
59	4	Räkor, konserverade	Shrimps, canned		2,0	1 burk	20	30	14
									185
61	5	Lättmjölk	Milk, 0,5 % milk		21,3	1 L	213	0	213
62	5	Mellanmjölk	Milk, 1,5 % fat		49,4	1 L	494	0	494
63	5	Mjölk 3%	Milk, 3% fat		25,9	1 L	259	0	259
64	5	Lättfil	Fermented milk, 0,5 % fat		8,7	1 L	29	0	29
66	5	Lättyoghurt	Yoghurt, 0,5 % fat		8,7	1 L	29	0	29
66	5	Lättyoghurt med frukt	Fruit yoghurt, 0,5 % fat		8,7	1 L	29	0	29
67	5	Mellanfil	Fermented milk, 1,5 % fat		5,1	1 L	51	0	51
65	5	Fil 3%	Fermented milk, 3 % fat		18,6	1 L	61	0	61
68	5	Fruktyoghurt fett > 2%	Fruit yoghurt, >2 % fat		18,6	1 L	61	0	61
68	5	Yoghurt, naturell 3%	Plain yoghurt, 3 % fat		18,6	1 L	61	0	61
70	5	Grädde 12%	Cream, 12 % fat		2,1	3 dL	21	0	21
71	5	Gräddfil	Sour cream, 12 % fat		1,6	3 dL	16	0	16
72	5	Vispgrädde 40%	Whipping cream, 40 % fat		5,5	3 dL	55	0	55
75	5	Hårdost 28%	Cheese, 28 % fat		12,6	0.5 kg	113	0	113
75	5	Hårdost 17%	Cheese, 17 % fat		12,6	0.5 kg	13	0	13
76	5	Smältost 10%	Cheese spread, 10 % fat		1,5	1 pkt	15	0	15
78	5	Keso	Cottage cheese		3,7	250g	28	0	28
78	5	Dessertost 45+	Dessert ch., camenbert type	Camenbert-typ	3,7	1 pkt	9	0	9

									1557
80	6	Ägg	Eggs		9,6	6 ägg	96	12	*84*
82	7	Smör	Butter	Smör, normalsaltat	1,8	400 g	18	0	18
83	7	Marg. folie 75-80% (33%)	Baking margarine (33%)	Milda 80%, ICA	5,8	1 kg	19	0	19
83	7	Marg. bords 70-80% (33%)	Table marg., 70-80 % fat(33%)	Bregott 75%	5,8	600 g	19	0	19
83	7	Marg. bords 70-80% (3%)	Table marg., 70-80 % fat (3%)	Becel Gold 70%	5,8	400 g	2	0	2
83	7	Flytande marg. 80% (16%)	Liquid marg., 80 % fat (16%)	Milda, EVM	5,8	500 g	9	0	9
83	7	Marg. bords 60% (10%)	Table marg., 60 % fat (10%)	Bregott mellan 60%	5,8	600 g	6	0	6
83	7	Marg. bords 60% (5%)	Table marg., 60 % fat (5%)	Milda bords, Carlsh.	5,8	600 g	3	0	3
84	7	Lättmargarin (85%)	Low-fat margarine (85%)	Becel, Lätta, ICA, Willys	4,0	750 g	34	0	34
84	7	Lättmargarin (15%)	Low-fat margarine (15%)	Lätt&lagom	4,0	750 g	6	0	6
86	7	Majonnäs	Mayonnaise	Majonnäs	1,1	1 + 1 burk	11	0	11
87	7	Matolja (55%)	Cooking oil, rapeseed (55%)	Matolja, raps	1,8	½-1 L	10	0	10
87	7	Matolja (27%)	Cooking oil, olive (27%)	Matolja, oliv	1,8	½-1 L	5	0	5
87	7	Matolja (18%)	Cooking oil, corn (18%)	Matolja, majs	1,8	½-1 L	3	0	3
							145		*145*
89	8	Morötter	Carrots		7,8	½ kg	78	12	69
90	8	Rödbetor	Beetroots		1,7	½ kg	17	20	14
92	8	Gurka	Cucumber		5,1	1 st	51	5	48
93	8	Gul lök	Brown onion		7,5	½ kg	75	7	70
94	8	Purjolök	Leek		1,1	2 st	11	16	9
95	8	Blomkål	Cauliflower		0,9	1 st	9	21	7
96	8	Vitkål	White cabbage		5	1 st	50	20	40
97	8	Isbergssallat	Iceberg lettuce		5,7	1 st	57	5	54
98	8	Tomater	Tomatoes		10,1	½ kg	101	0	101
99	8	Paprika, grön	Capsicum/pepper		8,5	3 st	85	15	72
101	8	Ärter o morot, frysta (79%)	Frozen peas and carrots (79%)		5,5	1 pkt	43	0	43
101	8	Spenat, fryst (21%)	Spinach, frozen (21%)		5,5	1 pkt	12	0	12
102	8	Gula ärter, torkade	Yellow peas, dried		0,7	1 pkt	7	0	7
103	8	Ättiksgurkor	Pickled cucumber		3,3	1 burk	33	33	22
104	8	Ärter o morot, kons (25%)	Canned peas and carrots(25%)		12,1	1 burk	30	33	20
104	8	Champinjoner, kons (25%)	Canned mushrooms (25%)		12,1	1 burk	30	33	20
104	8	Gröna bönor, kons (10%)	Canned green beans (10%)		12,1	1 burk	12	33	8
104	8	Tomater, konserv (40%)	Canned tomates (40%)		12,1	1 burk	48	0	48
118	8	Grönsakssoppa, konserv	Canned vegetable soup		4	1 burk	40	0	40
									704

106	9	Apelsiner	Oranges		18,4	1 kg	184	29	131
107	9	Vindruvor	Grapes		2,9	300g	12	4	11
108	9	Hasselnötter, kärnor	Hazelnuts		2,5	1 påse	10	0	10
109	9	Äpplen (82%)	Apples		16	1 kg	131	8	121
109	9	Päron (18%)	Pears		16	300g	29	8	26
110	9	Persika/nektarin alt plommo	Peach, nectarine		2,9	3 st	29	13	25
111	9	Bananer (80%)	Bananas (80%)		22,6	1 kg	194	37	122
111	9	Meloner (10%)	Melon (10%)		22,6	½-1 st	23	48	12
111	9	Kiwi (10%)	Kiwi (10%)		22,6	3 st	23	15	19
112	9	Jordgubbar, färska/frysta	Strawberry, fresh/frozen		2,5	200g	25	0	25
114	9	Russin	Raisins		1,3	½ kg	13	0	13
115	9	Persikohalvor, kons.	Canned peaches		4,2	1 burk	42	0	42
116	9	Lingonsylt	Lingonberry jam		7,4	1 burk	74	0	74
120	9	Apelsinjuice, konc (20%)	Orange juice (20%)		23,6	1 pkt	47	0	47
120	9	Apelsinjuice, drickf.(10%)	Orange juice, re-to-drink(10%)		23,6	1 L	24	0	24
120	9	Äppeljuice, konc (10%)	Apple juice (10%)		23,6	1 pkt	24	0	24
120	9	Saft/fruktdryck drickf.(15%)	Cordial re-to-dr (15%)	3 sorter	23,6	1 fl	35	0	35
120	9	Blandsaft, konc (45%)	Cordial, conc., mixed fr. (45%)		23,6	1 fl	106	0	106
									867
122	10	Potatis	Potatoes		44,9	2 kg	449	22	350
123	10	Potatismospulver komplett	Mashed potatoes, powder		0,5	1 pkt	5	0	5
125	10	Pommes frites, frysta	French fries, frozen		8,7	1 pkt	87	0	87
127	10	Chips	Crisps		1,6	100g	16	0	16
									458
130	11	Strösocker	Caster sugar		6,4	1 kg	64	0	64
137	11	Drickchokladpulver	Choclate powder	typ O'boy, ICAHandlarnas	2,1	½ kg	21	0	21
139	11	Honung	Honey		0,7	350 g	7	0	7
140	11	Chokladpraliner (51%)	Choclate pieces (51%)	t.ex. Aladin, Cloetta mfl	15,2	300g	78	0	78
140	11	Konf, typ lösgodis (49%)	Candy (49%)		15,2	300g	74	0	74
141	11	Ketchup (80%)	Ketchup (80%)		13,6	½ kg	109	0	109
141	11	Såser ex. bearn./holl. (10%)	Sauce Bearn.Hollandise(10%)		13,6		14	0	14
141	11	Salladsdressing (10%)	Salad dressing (10%)		13,6		14	0	14
142	11	Glass 10% fett, vanilj	Vanilla ice cream, 10 % fat	Big pack, Mjukisglass, Triumf/I	11,3	1 pkt	28	0	28
142	11	Glasspinne	Ice cream	88an, Magnum, 1 av varje	11,3	1 st	28	0	28
145	11	Senap (85%), kryddor m.m.	Mustard (85%), spices etc.		1,9	1 burk	16	0	16
									453

148	12	Läsk (90%)	Soda (90%)	fruktsoda, cola, socker-dricka e	87,7	3 brk	789	0	789
148	12	Lightläsk (10%)	Soda, light (10%)	lightvarianter	87,7	3 brk	88	0	88
149	12	Mineralvatten	Mineral water	typ Vichy Noveau, Ramlösa el r	10,8	2 brk	108	0	108
151	12	Lättöl	Non-alcoholic beer	3 vanliga märken	4,5	3 brk	45	0	45
152	12	Öl 2,8%	Beer, 2,8 % alcohol	3 vanliga märken	17,5	3 brk	175	0	175
									1205

Annex B

Calculation of population-based mean body weight – Market Basket 2010

This calculation is based on the mean body weights obtained from the national dietary survey Riksmaten 2010-2011 (ages: 18 – approx. 75 yr), after which an adjustment is made for the younger age classes that are not represented in the Riksmaten survey.

Basic data:

- SCB's (the Swedish Statistical Agency) population tables, 1 No. 2011, stratified for age classes (from SCB's web site)
- Weight curve for Swedish children, age 0-17
- Data on mean weight for adults in the Riksmaten survey (in-house data, report not yet published, 2012-05-15)

1. Define a mean weight for each age class 0-17 yr according to the weight curve for children

2. Number of individuals and mean weight are multiplied for each age class, and all these products are added together for all age classes. Thereafter, this sum is divided by the whole population number, 0-17 yr. This is made separately for boys and girls.
   Result: boys 32.8 kg; girls 32.8 kg (!)

3. Calculate the quotient of the population that consists of boys/girls 0-17 yr.
   Result: boys 20.6%; girls 19.4%; all 20.1%

4. Show data on mean weight of men and women in the Riksmaten survey.
   Result: men 84.2 kg; women 69.2 kg; all 75.8 kg

5. Use a weighted mean for boys/men and girls/women from these data (eg. 0.21 x mean wt. boys + 1-0.21 x mean wt, men; the same calculation for women)
   Result: boys/men: 0.21 x 32.8 + 0.79 x 84.2 = 73.4 kg; girls/women: 62.3 kg; all: 67.2 kg

Annex C: Concentrations of trans fatty acids in the food groups sampled in 2010.

Sample	s-p	l-p	s-p	l-p	s-p	l-p
	Cereal produts	**Cereal produts**	**Pastries**	**Pastries**	**Meat**	**Meat**
GC-date	2011-09-09	2011-09-09	2011-09-09	2011-09-09	2011-09-09	2011-09-09
Method	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth
Fatty acid	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 14:1 trans					0,090	0,065
C 16:1 trans					0,186	0,156
C 18:1 trans	0,153	0,096	0,423	0,231	1,064	0,838
C 18:2 trans	0,064	0,049	0,285	0,282	0,305	0,266
C 18:3 trans	0,171	0,194	0,185	0,143		
C 20:1 trans						
Total trans	0,39	0,34	0,89	0,66	1,65	1,33

Sample	s-p	l-p	s-p	l-p	s-p	l-p
	Fish	**Fish**	**Dairy prod.**	**Dairy prod.**	**Eggs**	**Eggs**
GC-date	2011-09-10	2011-09-10	2011-09-24	2011-09-24	2011-09-10	2011-09-10
Method	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth
Fatty acid	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 14:1 trans			0,422	0,418		
C 16:1 trans	0,081	0,079	0,375	0,417		
C 18:1 trans	0,156	0,171	2,643	2,710	0,191	0,192
C 18:2 trans	0,305	0,302	0,713	0,648	0,101	0,057
C 18:3 trans	0,288	0,243				
C 20:1 trans						
Total trans	0,83	0,80	4,15	4,19	0,29	0,25

Sample	s-p	l-p	s-p	l-p	s-p	l-p
	Fats	**Fats**	**Vegetables**	**Vegetables**	**Fruits**	**Fruits**
GC-date	2011-09-24	2011-09-24	2011-10-04	2011-10-04	2011-09-27	2011-10-06
Method	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth	Trans mth
Fatty acid	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 14:1 trans						
C 16:1 trans	0,111	0,090				
C 18:1 trans	0,629	0,687	0,479	0,441		
C 18:2 trans	0,183	0,223				
C 18:3 trans	0,257	0,196				
C 20:1 trans						
Total trans	1,18	1,20	0,48	0,44		

Sample	s-p	l-p	s-p	l-p
	Potatoes	**Potatoes**	**Sugar, sweets**	**Sugar, sweets**
GC-date	2011-10-06	2011-09-25	2011-09-26	2011-10-04
Method	Trans mth	Trans mth	Trans mth	Trans mth
Fatty acid	**area %**	**area %**	**area %**	**area %**
C 14:1 trans				
C 16:1 trans				
C 18:1 trans	0,103	0,097	0,230	0,243
C 18:2 trans	0,264	0,199	0,113	0,112
C 18:3 trans			0,142	0,106
C 20:1 trans				
Total trans	0,37	0,30	0,49	0,46

No value for a fatty acid means <LOD = 0,03 %.
s-p = standard-price and l-p = low-price

Annex D: Concentrations of individual fatty acids in the food groups sampled in 2010.

Sample	s-p **Cereal products**	l-p **Cereal products**	s-p **Pastries**	l-p **Pastries**	s-p **Meat**	l-p **Meat**
GC-date	2011-08-22	2011-08-22	2011-08-29	2011-08-29	2011-08-22	2011-08-22
GC-method	Fettsyra mth	Fettsyra mth	Bregott mth	Bregott mth	Fettsyra mth	Fettsyra mth
Fatty acids	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 4:0						
C 6:0			0,11	0,05		
C 8:0			0,75	0,59		
C 10:0	0,19		0,87	0,64	0,08	0,07
C 12:0	0,30	0,07	8,25	6,98	0,21	0,10
C 13:0						
C 14:0	0,87	0,17	4,33	3,52	2,19	1,81
C 14:1	0,06		0,07		0,47	0,31
C 15:0 i					0,10	0,07
C 15:0 ai					0,10	0,07
C 15:0	0,11		0,11	0,06	0,26	0,19
C 15:1						
C 16:0 i					0,10	0,06
C 16:0 ai						
C 16:0	15,1	13,2	25,9	27,1	24,6	23,9
C 16:1	0,36	0,22	0,35	0,31	3,78	3,33
C 16:2 n-4						
C 16:3						
C 16:4 n-3						
C 17:0 i					0,23	0,17
C 17:0 ai					0,32	0,24
C 17:0	0,10	0,07	0,12	0,10	0,62	0,57
C 17:1	0,07	0,06	0,06	0,05	0,60	0,54
C 18:0 i					0,08	0,06
C 18:0 ai						
C 18:0	3,61	2,58	7,23	5,55	13,1	13,3
C 18:1	36,8	39,2	37,0	39,4	43,1	43,8
C 18:2	35,1	36,7	11,6	12,1	6,57	7,91
C 18:2 cis n-6	35,1	36,7	11,5	12,0	5,91	7,36
C 18:2 konj	0,04				0,27	0,21
C 18:3 n-3	4,89	5,47	1,97	2,23	0,72	0,83
C 18:3 n-6						
C 18:4 n-3						
C 20:0	0,36	0,39	0,41	0,40	0,18	0,20
C 20:1	0,85	0,90	0,39	0,43	0,73	0,83
C 20:2 n-6	0,10	0,08			0,28	0,29
C 20:3 n-3					0,09	0,09
C 20:3 n-6					0,11	0,10
C 20:4 n-3						
C 20:4 n-6				0,03	0,36	0,36
C 20:5 n-3					0,08	0,05
C 21:5 n-3						
C 22:0	0,25	0,27	0,13	0,14		
C 22:1	0,34	0,33	0,07	0,09		
C 22:2 n-6						
C 22:4 n-3						
C 22:4 n-6					0,07	0,08
C 22:5 n-3					0,12	0,13
C 22:5 n-6						
C 22:6 n-3						
C 23:0						
C 24:0	0,14	0,14	0,08	0,08		
C 24:1 n-9	0,11	0,11				
Others						
Unknown	0,20	0,17	0,19	0,11	0,49	0,44

No value for a fatty acid means <LOD = 0,03 %.

s-p = standard-price and l-p = low-price

Annex D: Concentrations of individual fatty acids in the food groups sampled in 2010.

Sample	s-p **Fish**	l-p **Fish**	s-p **Dairy prod.**	l-p **Dairy prod.**	s-p **Eggs**	l-p **Eggs**
GC-date	2011-08-22	2011-08-22	2011-09-23	2011-09-22	2011-08-23	2011-08-23
GC-Method	Fettsyra mth	Fettsyra mth	Bregott mth	Bregott mth	Fettsyra mth	Fettsyra mth
Fatty acids	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 4:0			2,77	2,73		
C 6:0			1,54	1,52		
C 8:0			1,18	1,16		
C 10:0			2,89	2,85		
C 12:0	0,11		3,50	3,47		
C 13:0			0,09	0,09		
C 14:0	2,80	2,92	10,8	10,8	0,30	0,32
C 14:1			0,92	0,90		
C 15:0 i	0,11	0,12	0,24	0,24		
C 15:0 ai			0,42	0,42		
C 15:0	0,23	0,23	0,96	0,94	0,07	0,06
C 15:1						
C 16:0 i			0,21	0,21		
C 16:0 ai						
C 16:0	9,42	8,93	29,5	29,7	23,7	23,8
C 16:1	2,49	2,26	1,72	1,71	3,02	2,97
C 16:2 n-4	0,36	0,33				
C 16:3	0,10	0,08				
C 16:4 n-3	0,16	0,14				
C 17:0 i	0,12	0,11	0,46	0,46		
C 17:0 ai	0,06		0,44	0,44		
C 17:0	0,20	0,19	0,53	0,52	0,18	0,17
C 17:1	0,18	0,18	0,29	0,29	0,16	0,15
C 18:0 i	0,10	0,10	0,05	0,05		
C 18:0 ai						
C 18:0	2,24	2,16	10,8	10,9	8,49	8,60
C 18:1	35,9	35,2	23,4	23,9	46,1	45,8
C 18:2	15,2	16,5	3,32	3,23	12,9	13,0
C 18:2 cis n-6	15,0	16,3	2,15	2,11	12,9	13,0
C 18:2 konj			0,58	0,58	0,08	0,10
C 18:3 n-3	4,53	4,48	0,62	0,60	1,06	0,88
C 18:3 n-6	0,10	0,10			0,07	0,07
C 18:4 n-3	1,36	1,52				
C 20:0	0,35	0,36	0,17	0,17		
C 20:1	4,69	5,04	0,28	0,26	0,32	0,32
C 20:2 n-6	0,25	0,21			0,12	0,12
C 20:3 n-3	0,12	0,10				
C 20:3 n-6	0,06	0,05	0,09	0,09	0,13	0,13
C 20:4 n-3	0,53	0,45				
C 20:4 n-6	0,33	0,28	0,13	0,12	1,59	1,70
C 20:5 n-3	3,50	3,19				
C 21:5 n-3	0,18	0,16				
C 22:0	0,25	0,28	0,08	0,06		
C 22:1	5,93	6,88				
C 22:2 n-6						
C 22:4 n-3						
C 22:4 n-6					0,09	0,10
C 22:5 n-3	0,84	0,64			0,12	0,10
C 22:5 n-6	0,15	0,13			0,15	0,18
C 22:6 n-3	6,07	5,61	0,07		1,25	1,15
C 23:0						
C 24:0	0,08	0,08				
C 24:1 n-9	0,49	0,47			0,08	0,09
Others			0,56	0,50		
Unknown	0,46	0,59	1,54	1,15	0,05	0,09

No value for a fatty acid means <LOD = 0,03 %.
s-p = standard-price and l-p = low-price

Annex D: Concentrations of individual fatty acids in the food groups sampled in 2010.

Sample	s-p	l-p	s-p	l-p	s-p	l-p
	Fats	**Fats**	**Vegetables**	**Vegetables**	**Fruits**	**Fruits**
GC-date	2011-09-23	2011-09-23	2011-10-04	2011-10-04	2011-09-26	2011-10-03
Method	Bregott mth	Bregott mth	Fettsyra mth	Fettsyra mth	Fettsyra mth	Fettsyra mth
Fatty acids	**area %**	**area %**	**area %**	**area %**	**area %**	**area %**
C 4:0	0,73	0,81				
C 6:0	0,41	0,45				
C 8:0	0,43	0,47				
C 10:0	0,89	0,93				
C 12:0	2,59	2,85	0,42	0,46	0,07	0,07
C 13:0						
C 14:0	4,07	4,13	0,73	0,51	0,09	0,08
C 14:1	0,24	0,24				
C 15:0 i	0,07	0,07				
C 15:0 ai	0,11	0,11	0,10	0,11		
C 15:0	0,30	0,29	0,30	0,37	0,05	
C 15:1						
C 16:0 i	0,06	0,06				
C 16:0 ai						
C 16:0	20,5	21,5	21,6	19,4	7,06	6,80
C 16:1	0,63	0,60	0,85	0,96	0,39	0,37
C 16:2 n-4						
C 16:3						
C 16:4 n-3						
C 17:0 i	0,14	0,13	0,13	0,17		
C 17:0 ai	0,13	0,13				
C 17:0	0,21	0,19	0,25	0,28	0,07	0,07
C 17:1	0,11	0,11	0,37	0,45	0,09	0,08
C 18:0 i						
C 18:0 ai						
C 18:0	5,69	5,94	3,08	2,68	2,61	2,48
C 18:1	39,3	40,8	14,9	12,0	76,8	76,5
C 18:2	16,4	14,1	41,3	43,9	10,6	11,1
C 18:2 cis n-6	16,1	13,7	41,1	43,8	10,6	11,1
C 18:2 konj	0,15	0,13				
C 18:3 n-3	4,83	4,08	11,4	12,7	0,88	0,91
C 18:3 n-6						
C 18:4 n-3						
C 20:0	0,43	0,42	0,64	0,65	0,20	0,19
C 20:1	0,63	0,59	0,30	0,35	0,17	0,17
C 20:2 n-6			0,14	0,17		
C 20:3 n-3						
C 20:3 n-6			0,16	0,10		
C 20:4 n-3						
C 20:4 n-6						
C 20:5 n-3						
C 21:5 n-3						
C 22:0	0,43	0,28	0,56	0,61	0,10	0,11
C 22:1	0,11	0,10	0,77	0,96		
C 22:2 n-6						
C 22:4 n-3						
C 22:4 n-6						
C 22:5 n-3						
C 22:5 n-6						
C 22:6 n-3						
C 23:0						
C 24:0	0,10	0,09	0,54	0,65	0,07	0,10
C 24:1 n-9	0,08	0,09		0,16		
Others	0,06	0,07				
Unknown	0,16	0,22	1,35	2,36	0,78	0,92

No value for a fatty acid means <LOD = 0,03 %.

s-p = standard-price and l-p = low-price

Annex D: Concentrations of individual fatty acids in the food groups sampled in 2010.

Sample	s-p	l-p	s-p	l-p
	Potatoes	**Potatoes**	**Sugar, sweets**	**Sugar, sweets**
GC-date	2011-10-03	2011-09-23	2011-09-27	2011-09-27
Method	Fettsyra mth	Fettsyra mth	Fettsyra mth	Fettsyra mth
Fatty acids	**area %**	**area %**	**area %**	**area %**
C 4:0				
C 6:0				
C 8:0			0,72	0,67
C 10:0			0,82	0,75
C 12:0	0,15	0,18	6,42	4,67
C 13:0				
C 14:0	0,53	0,67	3,49	2,82
C 14:1			0,09	0,09
C 15:0 i				
C 15:0 ai				
C 15:0	0,04	0,05	0,12	0,13
C 15:1				
C 16:0 i				
C 16:0 ai				
C 16:0	20,9	28,5	20,0	21,6
C 16:1	0,19	0,19	0,32	0,33
C 16:2 n-4				
C 16:3				
C 16:4 n-3				
C 17:0 i				
C 17:0 ai				
C 17:0	0,07	0,08	0,17	0,18
C 17:1	0,04		0,06	0,06
C 18:0 i				
C 18:0 ai				
C 18:0	4,02	4,33	17,8	19,1
C 18:1	59,6	56,6	37,7	36,6
C 18:2	11,9	7,56	8,01	9,07
C 18:2 cis n-6	11,8	7,44	7,96	8,90
C 18:2 konj				
C 18:3 n-3	0,61	0,23	2,53	1,90
C 18:3 n-6				
C 18:4 n-3				
C 20:0	0,40	0,40	0,66	0,67
C 20:1	0,31	0,25	0,45	0,44
C 20:2 n-6				
C 20:3 n-3				
C 20:3 n-6				
C 20:4 n-3				
C 20:4 n-6				
C 20:5 n-3				
C 21:5 n-3				
C 22:0	0,55	0,42	0,18	0,17
C 22:1	0,17	0,18	0,43	0,57
C 22:2 n-6				
C 22:4 n-3				
C 22:4 n-6				
C 22:5 n-3				
C 22:5 n-6				
C 22:6 n-3				
C 23:0				
C 24:0	0,25	0,18	0,09	
C 24:1 n-9				
Others				
Unknown	0,20	0,23	0,00	0,22

No value for a fatty acid means <LOD = 0,03 %.
s-p = standard-price and l-p = low-price

Annex E

Results in mg/kg fresh weight in mg/kg

Food group	Mo	Ag	Cd	Hg	Pb	Al	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se
Cereal products C1:1	0,33	< 0,007	0,022	< 0,003	0,002	0,93	< 0,013	10,7	15,4	0,010	0,16	1,85	12,4	0,012	0,016
Cereal products C2:1	0,34	< 0,007	0,023	< 0,003	0,003	1,18	< 0,013	8,62	13,5	0,011	0,11	1,81	11,8	< 0,030	0,024
Cereal products I1:1	0,37	< 0,007	0,016	< 0,003	0,002	1,13	< 0,013	8,85	14,3	0,015	0,17	1,82	10,8	< 0,030	0,017
Cereal products I2:1	0,28	< 0,007	0,016	< 0,003	0,003	1,08	< 0,013	7,76	12,6	0,011	0,09	1,55	11,3	< 0,030	0,012
Cereal products W1:1	0,36	< 0,007	0,019	< 0,003	0,003	0,71	0,014	9,67	20,3	0,009	0,16	1,79	11,5	< 0,030	0,035
Cereal products W2:1	0,30	< 0,007	0,019	< 0,003	0,003	2,01	0,019	8,71	15,0	0,013	0,10	1,86	11,2	< 0,030	0,020
Cereal products H1:1	0,42	< 0,007	0,023	< 0,003	0,002	0,86	< 0,013	11,5	16,5	0,013	0,20	2,11	13,8	< 0,033	0,033
Cereal products H2:1	0,35	< 0,007	0,017	< 0,003	0,003	2,39	0,021	9,11	19,5	0,011	0,13	1,86	11,1	< 0,033	0,009
Cereal products L1:1	0,38	< 0,007	0,018	< 0,003	0,003	1,17	< 0,013	10,1	15,5	0,009	0,18	1,98	13,7	< 0,030	0,035
Pastries C1:2	0,14	< 0,007	0,012	< 0,003	0,002	1,85	0,040	4,21	10,1	0,016	0,15	1,30	6,74	< 0,030	0,010
Pastries C2:2	0,13	< 0,007	0,014	< 0,003	0,005	3,69	0,041	4,87	11,6	0,017	0,20	1,24	7,24	< 0,030	0,024
Pastries I1:2	0,29	< 0,007	0,011	< 0,003	0,003	1,88	0,040	6,11	10,3	0,015	0,27	1,43	8,01	< 0,030	0,016
Pastries I2:2	0,10	< 0,007	0,013	< 0,003	0,003	2,38	0,026	2,98	9,3	0,019	0,19	1,61	6,21	< 0,030	0,015
Pastries W1:2	0,11	< 0,007	0,014	< 0,003	0,011	3,73	0,050	4,51	15,8	0,036	0,29	1,74	6,47	< 0,030	0,012
Pastries W2:2	0,15	< 0,007	0,013	< 0,003	0,003	1,96	0,035	4,44	10,2	0,013	0,16	1,57	7,02	< 0,030	0,009
Pastries H1:2	0,20	< 0,007	0,012	< 0,003	0,004	3,02	0,063	6,82	14,5	0,026	0,36	1,81	8,57	< 0,030	0,014
Pastries H2:2	0,15	< 0,007	0,012	< 0,003	0,002	1,30	0,031	5,08	10,7	0,016	0,17	1,56	7,63	< 0,030	0,012
Pastries L1:2	0,23	< 0,007	0,008	< 0,002	0,007	24,3	0,056	8,50	14,1	0,018	0,46	1,66	8,98	< 0,030	0,004
Meat C1:3	0,041	< 0,003	0,002	< 0,002	< 0,007	0,31	0,008	0,42	13,0	0,001	0,009	0,66	20,7	< 0,013	0,059
Meat C2:3	0,036	< 0,003	0,002	< 0,002	0,023	0,29	0,011	0,43	12,2	0,001	0,009	0,62	20,0	< 0,013	0,063
Meat I1:3	0,041	< 0,003	0,002	< 0,002	< 0,007	0,29	0,021	0,41	12,7	0,001	0,011	0,64	19,9	< 0,013	0,053
Meat I2:3	0,037	< 0,003	0,002	< 0,002	< 0,007	0,21	0,048	0,25	13,4	0,001	0,007	0,60	18,6	< 0,013	0,082
Meat W1:3	0,041	< 0,003	0,002	< 0,002	< 0,007	0,34	0,034	0,36	13,5	0,001	0,013	0,63	18,5	< 0,013	0,052
Meat W2:3	0,033	< 0,003	0,001	< 0,002	< 0,007	0,68	0,016	0,39	11,6	0,002	0,010	0,55	16,1	< 0,013	0,070
Meat H1:3	0,038	< 0,003	0,002	< 0,002	< 0,007	4,33	0,018	0,31	10,9	0,001	0,014	0,57	15,8	< 0,013	0,064
Meat H2:3	0,035	< 0,003	0,002	< 0,002	< 0,007	0,49	0,011	0,30	10,8	0,001	0,011	0,58	15,7	< 0,013	0,070
Meat L1:3	0,036	< 0,003	0,001	< 0,002	< 0,007	0,44	0,032	0,39	13,5	0,002	0,011	0,60	16,9	< 0,013	0,076
Fish C1:4	0,009	0,006	0,004	0,040	< 0,007	0,30	0,013	0,25	3,62	0,003	0,010	0,57	7,20	3,03	0,26
Fish C2:4	0,010	0,004	0,011	0,044	< 0,007	0,22	0,013	0,21	4,56	0,003	0,014	0,60	6,75	2,17	0,28
Fish I1:4	0,007	0,004	0,004	0,027	< 0,007	0,15	0,018	0,32	3,31	0,003	0,012	0,54	6,21	3,26	0,28
Fish I2:4	0,010	0,004	0,004	0,033	< 0,007	0,25	0,044	0,23	4,03	0,004	0,026	0,60	6,13	2,66	0,25
Fish W1:4	0,011	0,004	0,004	0,029	< 0,007	0,26	0,055	0,34	5,03	0,004	0,030	0,50	8,78	3,48	0,29
Fish W2:4	0,009	< 0,003	0,004	0,027	< 0,007	0,28	0,023	0,32	3,54	0,003	0,017	0,54	5,65	1,89	0,24

Fish H1:4	0,007	< 0,003	0,003	0,028	< 0,007	0,20	0,019	0,23	2,97	0,004	0,014	0,54	5,94	3,27	0,26
Fish H2:4	0,011	< 0,003	0,006	0,058	< 0,007	0,24	0,028	0,26	6,72	0,003	0,018	0,54	6,02	1,83	0,26
Fish L1:4	0,012	0,005	0,006	0,035	< 0,007	0,46	0,022	0,36	3,43	0,003	0,016	0,54	5,01	1,12	0,22
Dairy products C1:5	0,068	0,00003	0,00004	< 0,00003	0,001	0,02	0,005	0,04	0,30	0,0003	0,004	0,10	5,90	0,0003	0,018
Dairy products C2:5	0,047	0,00002	0,00003	< 0,00003	0,001	0,02	0,003	0,04	0,27	0,0003	0,002	0,083	5,62	0,0002	0,017
Dairy products I1:5	0,079	0,00002	0,00004	< 0,00003	0,001	0,03	0,003	0,05	0,29	0,0003	0,002	0,093	6,53	0,0003	0,015
Dairy products I2:5	0,043	0,00002	0,00003	0,0010	0,001	0,05	0,003	0,04	0,30	0,0003	0,002	0,089	6,59	0,0004	0,020
Dairy products W1:5	0,067	0,00005	0,00004	0,0000	0,001	0,02	0,003	0,04	0,29	0,0003	0,003	0,10	6,76	0,008	0,024
Dairy products W2:5	0,050	< 0,00002	0,00003	0,0001	0,002	0,02	0,002	0,07	0,27	0,0002	0,006	0,071	5,32	0,0002	0,016
Dairy products H1:5	0,077	< 0,00002	0,00004	0,0001	0,001	0,02	0,002	0,05	0,28	0,0003	0,002	0,087	6,21	0,0004	0,019
Dairy products H2:5	0,042	0,00002	0,00003	0,0001	0,001	0,03	0,016	0,05	0,36	0,0004	0,009	0,084	5,79	0,0003	0,017
Dairy products L1:5	0,042	0,00002	0,00003	0,0001	0,001	0,08	0,015	0,05	0,38	0,0005	0,010	0,10	7,23	0,0004	0,020
Eggs C1:6	0,043	< 0,007	< 0,002	< 0,003	< 0,007	< 0,01	0,007	0,45	18,9	0,001	0,001	0,58	11,6	< 0,017	0,16
Eggs C2:6	0,030	< 0,007	< 0,002	< 0,003	< 0,004	< 0,02	< 0,010	0,37	16,5	0,000	< 0,001	0,59	11,3	< 0,017	0,14
Eggs I1:6	0,056	< 0,007	< 0,002	< 0,003	< 0,013	< 0,02	< 0,010	0,39	17,4	0,000	< 0,001	0,63	11,1	< 0,017	0,14
Eggs I2:6	0,054	< 0,007	< 0,002	< 0,003	< 0,013	< 0,02	< 0,010	0,51	18,0	0,001	< 0,001	0,63	12,4	< 0,017	0,19
Eggs W1:6	0,084	< 0,007	< 0,002	< 0,003	< 0,013	< 0,02	< 0,010	0,45	19,4	0,001	0,002	0,66	13,3	< 0,017	0,20
Eggs W2:6	0,072	< 0,007	< 0,002	< 0,003	< 0,013	< 0,02	< 0,010	0,68	18,6	0,001	< 0,001	0,62	12,8	< 0,017	0,17
Eggs H1:6	0,071	< 0,007	< 0,002	< 0,003	< 0,013	< 0,03	< 0,010	0,44	16,6	0,001	< 0,001	0,60	11,7	< 0,017	0,19
Eggs H2:6	0,046	< 0,007	< 0,002	< 0,003	< 0,013	< 0,02	< 0,010	0,32	16,5	0,0004	< 0,001	0,58	10,7	< 0,017	0,16
Eggs L1:6	0,060	< 0,007	< 0,002	< 0,003	< 0,013	< 0,03	< 0,010	0,54	19,7	0,0005	< 0,001	0,65	12,4	< 0,017	0,16
Fats C1:7	0,008	< 0,007	0,002	< 0,003	< 0,017	0,08	< 0,010	0,04	0,43	< 0,0001	0,003	0,022	0,33	< 0,033	0,010
Fats C2:7	0,007	< 0,007	0,003	< 0,003	< 0,017	0,12	0,024	0,02	0,27	< 0,0001	0,010	0,018	0,22	< 0,033	0,020
Fats I1:7	0,011	< 0,007	0,004	< 0,003	< 0,017	0,09	0,032	0,06	0,48	0,0005	0,023	0,028	0,37	< 0,033	0,014
Fats I2:7	0,009	< 0,007	0,005	< 0,003	< 0,017	0,071	0,033	0,04	0,36	0,0003	0,012	0,032	0,33	< 0,033	0,010
Fats W1:7	0,008	< 0,007	0,006	< 0,003	< 0,017	0,072	0,027	0,04	0,38	0,0001	0,011	0,017	0,32	< 0,033	0,006
Fats W2:7	0,008	< 0,007	0,007	< 0,003	< 0,017	0,051	< 0,013	0,02	0,29	0,0001	0,007	0,021	0,24	< 0,033	0,020
Fats H1:7	0,010	< 0,007	0,008	< 0,003	< 0,017	0,251	0,017	0,05	0,45	< 0,0001	0,007	0,018	0,30	< 0,033	0,031
Fats H2:7	0,009	< 0,007	0,009	< 0,003	< 0,017	0,074	0,016	0,04	0,38	0,0001	0,009	0,019	0,31	< 0,033	0,007
Fats L1:7	0,007	< 0,007	0,010	< 0,003	< 0,017	< 0,033	< 0,013	< 0,02	0,12	0,0001	0,003	0,016	0,17	< 0,033	0,015
Vegetables C1:8	0,080	< 0,003	0,008	< 0,002	< 0,010	0,45	0,013	1,13	3,41	0,001	0,040	0,48	2,27	< 0,020	0,014
Vegetables C2:8	0,078	< 0,003	0,008	< 0,002	< 0,007	0,36	0,015	1,16	3,22	0,003	0,063	0,50	2,09	< 0,017	0,006
Vegetables I1:8	0,089	< 0,003	0,014	< 0,002	< 0,007	1,05	0,033	1,54	5,21	0,003	0,058	0,65	2,40	< 0,013	0,013
Vegetables I2:8	0,10	< 0,003	0,008	< 0,002	< 0,007	0,48	0,018	1,05	3,36	0,002	0,036	0,44	1,87	< 0,013	0,007
Vegetables W1:8	0,10	< 0,003	0,006	< 0,002	< 0,007	0,40	0,016	1,03	4,01	0,002	0,038	0,59	2,08	< 0,013	0,017
Vegetables W2:8	0,11	< 0,003	0,004	< 0,002	< 0,007	0,54	0,013	1,15	4,10	0,003	0,038	0,53	2,11	< 0,013	0,012
Vegetables H1:8	0,080	< 0,003	0,005	< 0,002	< 0,007	1,37	0,015	1,00	3,65	0,003	0,042	0,60	2,08	< 0,013	0,007
Vegetables H2:8	0,068	< 0,003	0,008	< 0,002	< 0,007	1,00	0,014	1,06	3,68	0,002	0,039	0,45	1,87	< 0,013	0,006

Vegetables L1:8	0,11	< 0,003	0,006	< 0,002	< 0,007	0,55	0,014	1,05	4,87	0,002	0,034	0,61	1,77	< 0,013	0,007
Vegetables L2:8	0,055	< 0,003	0,011	< 0,002	< 0,007	0,85	0,016	1,34	4,08	0,002	0,027	0,34	1,63	< 0,013	0,007
Vegetables C1:8H	0,064	< 0,003	0,008	< 0,002	< 0,007	1,31	0,019	1,22	4,14	0,002	0,034	0,48	2,09	< 0,013	0,004
Vegetables I1:8H	0,082	< 0,003	0,008	< 0,002	< 0,007	0,36	0,015	1,16	3,53	0,002	0,059	0,49	1,98	< 0,013	0,006
Vegetables W1:8H	0,10	< 0,003	0,012	< 0,002	< 0,007	0,36	0,011	1,35	3,95	0,002	0,032	0,44	2,03	< 0,013	0,003
Vegetables H1:8H	0,066	< 0,003	0,012	< 0,002	< 0,007	0,70	0,019	1,43	3,35	0,002	0,041	0,40	2,03	< 0,013	0,004
Fruits C1:9	0,018	< 0,007	0,001	< 0,003	< 0,010	0,83	0,012	3,74	2,90	0,008	0,082	0,90	1,18	0,002	0,004
Fruits C2:9	0,025	< 0,007	0,001	< 0,003	< 0,010	0,67	0,010	3,58	2,79	0,004	0,029	0,80	0,96	0,003	0,005
Fruits I1:9	0,016	< 0,007	0,001	< 0,003	< 0,010	0,77	0,017	3,48	2,27	0,007	0,072	0,78	1,04	0,003	0,010
Fruits I2:9	0,026	< 0,007	0,001	< 0,003	< 0,010	0,80	0,012	2,62	3,02	0,008	0,055	0,83	0,94	0,003	0,010
Fruits W1:9	0,024	< 0,007	0,001	< 0,003	< 0,010	0,78	0,048	2,71	2,82	0,005	0,097	0,74	1,12	0,004	0,006
Fruits W2:9	0,020	< 0,007	0,001	< 0,003	< 0,010	0,71	0,020	2,61	3,13	0,005	0,064	0,72	1,04	0,003	0,009
Fruits H1:9	0,023	< 0,007	0,001	< 0,003	< 0,010	0,93	0,013	3,88	3,14	0,011	0,072	0,99	1,16	0,004	0,011
Fruits H2:9	0,010	< 0,007	0,001	< 0,003	< 0,010	0,54	0,014	2,30	2,33	0,007	0,063	0,61	0,82	0,002	0,012
Fruits L1:9	0,021	< 0,007	0,001	< 0,003	< 0,010	0,79	0,015	2,10	2,56	0,009	0,057	1,01	0,87	0,003	0,008
Fruits L1:9H	0,013	< 0,007	0,002	< 0,003	< 0,010	0,78	0,014	3,58	2,70	0,010	0,089	0,98	0,98	< 0,002	0,013
Fruits C1:9H	0,012	< 0,007	0,001	< 0,003	< 0,010	0,70	0,008	3,21	2,44	0,005	0,063	0,79	0,97	0,003	0,008
Fruits I1:9H	0,018	< 0,007	0,001	< 0,003	< 0,010	0,64	0,014	1,83	2,24	0,004	0,044	0,78	0,92	0,003	< 0,002
Fruits H1:9H	0,010	< 0,007	0,002	< 0,003	< 0,010	0,71	0,017	2,77	3,58	0,005	0,060	1,00	1,16	0,004	0,011
Potatoes C1:10	0,046	< 0,007	0,018	< 0,003	< 0,013	< 0,27	0,010	1,35	4,16	0,005	0,028	0,57	3,63	< 0,003	0,019
Potatoes C2:10	0,059	< 0,007	0,012	< 0,003	< 0,013	< 0,23	< 0,010	1,54	4,94	0,004	0,031	0,77	3,13	< 0,003	0,011
Potatoes I1:10	0,095	< 0,007	0,018	< 0,003	< 0,013	< 0,22	0,012	1,38	4,22	0,010	0,049	1,00	3,00	< 0,003	0,011
Potatoes I2:10	0,060	< 0,007	0,023	< 0,003	< 0,013	< 0,27	< 0,010	1,37	4,14	0,006	0,038	1,23	2,72	< 0,003	0,007
Potatoes W1:10	0,036	< 0,007	0,013	< 0,003	< 0,013	< 0,20	0,010	1,28	4,60	0,006	0,028	0,79	3,24	< 0,003	0,008
Potatoes W2:10	0,033	< 0,007	0,012	< 0,003	< 0,013	< 0,23	< 0,010	1,04	3,84	0,005	0,023	0,67	2,83	< 0,003	0,011
Potatoes H1:10	0,065	< 0,007	0,022	< 0,003	< 0,013	< 0,23	< 0,010	1,01	4,43	0,004	0,016	0,74	2,36	< 0,003	0,017
Potatoes H2:10	0,038	< 0,007	0,013	< 0,003	< 0,013	< 0,27	< 0,010	1,12	4,34	0,008	0,024	0,43	2,36	< 0,003	0,008
Potatoes L1:10	0,043	< 0,007	0,013	< 0,003	< 0,013	1,11	0,012	1,39	4,56	0,005	0,031	0,66	2,25	< 0,003	0,005
Potatoes C1:1H	0,040	< 0,007	0,021	< 0,003	< 0,013	< 0,27	< 0,010	1,14	3,74	0,002	0,016	0,81	3,00	< 0,003	0,011
Potatoes I1:1H	0,058	< 0,007	0,019	< 0,003	< 0,013	< 0,27	< 0,010	1,37	5,22	0,009	0,054	1,11	3,04	< 0,003	0,016
Potatoes W1:1H	0,059	< 0,007	0,024	< 0,003	< 0,013	< 0,27	< 0,010	1,17	3,88	0,003	0,016	0,68	2,59	< 0,003	0,006
Potatoes H1:10H	0,085	< 0,007	0,009	< 0,003	< 0,013	< 0,27	< 0,010	1,15	4,07	0,003	0,013	0,54	2,35	< 0,003	0,005
Potatoes L1:10H	0,099	< 0,007	0,018	< 0,003	< 0,013	< 0,27	< 0,010	1,15	4,83	0,004	0,041	1,00	3,59	< 0,003	0,006
Sugar and sweets C1:	0,041	< 0,007	0,009	< 0,003	< 0,013	3,00	0,11	2,38	13,4	0,032	0,358	1,82	3,74	0,003	0,027
Sugar and sweets C2:	0,048	< 0,007	0,010	< 0,003	< 0,013	4,70	0,17	3,23	23,4	0,052	0,493	2,36	4,61	0,006	0,017
Sugar and sweets I1:1	0,045	< 0,007	0,007	< 0,003	< 0,013	3,36	0,12	1,83	12,7	0,027	0,296	1,50	3,64	< 0,003	0,021
Sugar and sweets I2:1	0,038	< 0,007	0,009	< 0,003	< 0,013	3,02	0,080	3,39	12,3	0,034	0,310	1,63	3,78	< 0,003	0,018
Sugar and sweets W1	0,046	< 0,007	0,010	< 0,003	< 0,013	4,60	0,11	2,10	12,0	0,035	0,328	1,53	3,81	0,004	< 0,003

Sugar and sweets W2	0,066	< 0,007	0,012	< 0,003	< 0,013	4,80	0,18	2,50	14,7	0,033	0,379	1,56	3,97	0,007	0,003
Sugar and sweets H1:	0,044	< 0,007	0,010	< 0,003	< 0,013	4,90	0,11	2,55	13,7	0,033	0,369	1,88	4,73	0,004	0,009
Sugar and sweets H2:	0,043	< 0,007	0,007	< 0,003	< 0,013	4,31	0,099	1,92	12,8	0,029	0,313	1,39	3,48	0,006	< 0,003
Sugar and sweets L1:·	0,049	< 0,007	0,009	< 0,003	< 0,013	4,43	0,12	3,57	12,8	0,037	0,376	2,04	4,55	0,003	0,004
Beverages C1:12	0,002	0,0001	0,00003	< 0,00003	0,001	0,07	0,007	0,03	0,48	0,001	0,016	0,065	0,02	0,001	0,002
Beverages I1:12	0,002	< 0,00002	0,00102	< 0,00003	0,001	0,21	0,001	0,02	0,03	< ######	0,001	0,038	0,02	0,000	0,002
Beverages W2:12	0,001	< 0,00002	0,00003	< 0,00003	0,001	0,13	0,001	0,02	0,05	0,0001	0,002	0,055	0,04	0,001	0,005
Beverages H1:12	0,002	0,00003	0,00002	< 0,00003	0,001	0,15	0,001	0,02	0,04	0,0001	0,003	0,028	0,02	0,001	0,003
Beverages L1:12	0,0005	< 0,00002	< 0,00002	< 0,0003	0,000	0,03	0,001	0,01	0,02	< ######	0,001	0,037	0,02	0,001	0,006

Annex F

Table 1. Levels of chlorinated pesticides in food homogenates of selected standard price market basket food groups. Values are given in ng/g fresh weight and values below the limit of quantification are given as <LOQ value

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	α-HCH	α-Chlordane	β-HCH	γ-HCH	γ-Chlordane	HCB	o.p'-DDT	Oxy-chlordane	p.p'-DDD	p.p'-DDE	p.p'-DDT	trans-Nonachlor
E1100026	C1:6	Eggs	Coop	10.3	<0.013		<0.013	<0.013		0.016	<0.025		<0.025	0.061	<0.025	
E1100028	I1:6	Eggs	ICA	8.72	<0.013		<0.013	<0.013		0.018	<0.025		<0.025	<0.025	<0.025	
E1100030	H1:6	Eggs	Hemköp	9.67	<0.013		<0.013	<0.013		0.051	<0.025		<0.025	0.123	<0.025	
E1100032	W1:6	Eggs	Willys	10.3	<0.013		<0.013	<0.013		0.019	<0.025		<0.025	0.083	<0.025	
E1100034	L1:6	Eggs	Lidl	9.67	<0.013		<0.013	<0.013		0.021	<0.025		<0.025	0.029	<0.025	
F1100263	C1:4	Fish	Coop	10.3	0.080	0.339	0.084	<0.063	<0.063	0.495	<0.13	0.097	0.731	2.49	0.470	0.436
F1100265	I1:4	Fish	ICA	11.0	0.099	0.380	0.084	<0.063	0.072	0.481	<0.13	0.097	0.726	1.89	0.395	0.456
F1100267	H1:4	Fish	Hemköp	9.66	0.073	0.348	0.081	<0.063	<0.063	0.539	<0.13	0.096	0.767	2.49	0.447	0.454
F1100269	W1:4	Fish	Willys	8.32	0.098	0.373	0.084	<0.063	0.068	0.498	<0.13	0.101	0.684	1.96	0.357	0.438
F1100271	L1:4	Fish	Lidl	14.3	0.113	0.469	<0.063	<0.063	0.084	0.589	<0.13	0.141	0.595	1.81	0.262	0.649
K1100001	C1:3	Meat	Coop	13.3	<0.013		<0.013	<0.013		0.108	<0.025		<0.025	0.142	0.035	
K1100003	I1:3	Meat	ICA	11.7	<0.013		<0.013	<0.013		0.458	<0.025		<0.025	0.173	<0.025	
K1100005	H1:3	Meat	Hemköp	11.9	<0.013		<0.013	<0.013		0.100	<0.025		<0.025	0.114	0.026	
K1100007	W1:3	Meat	Willys	13.4	<0.013		0.014	<0.013		0.115	<0.025		<0.025	0.316	<0.025	
K1100009	L1:3	Meat	Lidl	10.3	<0.013		<0.013	<0.013		0.074	<0.025		<0.025	0.169	0.069	
M1100012	C1:5	Dairy prod.	Coop	4.05	<0.013		<0.013	<0.013		0.040	<0.025		<0.025	0.054	<0.025	
M1100014	I1:5	Dairy prod.	ICA	9.94	<0.013		<0.013	<0.013		0.093	<0.025		<0.025	0.084	<0.025	
M1100016	H1:5	Dairy prod.	Hemköp	5.26	<0.013		<0.013	<0.013		0.062	<0.025		<0.025	0.055	<0.025	
M1100018	W1:5	Dairy prod.	Willys	7.07	<0.013		<0.013	<0.013		0.067	<0.025		<0.025	0.105	<0.025	
M1100020	L1:5	Dairy prod.	Lidl	4.78	<0.013		<0.013	<0.013		0.059	<0.025		<0.025	0.047	<0.025	
M1100021	C1:7	Fats	Coop	69.2	<0.063		<0.063	<0.063		0.201	<0.13		<0.13	0.460	<0.13	
M1100023	I1:7	Fats	ICA	65.7	<0.063		<0.063	<0.063		0.165	<0.13		<0.13	0.218	<0.13	
M1100025	H1:7	Fats	Hemköp	68.7	<0.063		<0.063	<0.063		0.215	<0.13		<0.13	0.417	<0.13	
M1100027	W1:7	Fats	Willys	68.3	<0.063		<0.063	<0.063		0.202	<0.13		<0.13	0.477	<0.13	
M1100029	L1:7	Fats	Lidl	65.7	<0.063		<0.063	<0.063		0.203	<0.13		<0.13	0.573	<0.13	

Annex F.

Table 2a. Levels of PBDE and HBCD in food homogenates of selected standard price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	BDE-28	BDE-47	BDE-66	BDE-99	BDE-100	BDE-138	BDE-153	BDE-154	BDE-183	BDE-209	HBCD
E1100026	C1:6	Eggs	Coop	10.7	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
E1100028	I1:6	Eggs	ICA	11.8	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	16.2	<5.0
E1100030	H1:6	Eggs	Hemköp	10.1	<2.5	6.07	<2.6	9.61	3.48	<2.5	2.77	2.89	<2.5	18.5	7.31
E1100032	W1:6	Eggs	Willys	9.65	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
E1100034	L1:6	Eggs	Lidl	9.07	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
F1100263	C1:4	Fish	Coop	10.5	10.5	184	32.5	45.1	50.5	<2.5	11.6	32.7	<2.5	<14	222
F1100265	I1:4	Fish	ICA	11.5	11.6	180	41.5	38.3	47.1	<2.5	8.95	26.5	<2.5	<14	180
F1100267	H1:4	Fish	Hemköp	9.65	7.32	125	21.2	20.8	29.8	<2.5	6.07	21.7	<2.5	15	194
F1100269	W1:4	Fish	Willys	8.23	8.47	118	19.2	25.7	32	<2.5	7.65	19.8	<2.5	<14	172
F1100271	L1:4	Fish	Lidl	14	10.1	111	12.2	21.3	25.4	<2.5	5.62	20.4	<2.5	<14	100
K1100001	C1:3	Meat	Coop	12.8	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
K1100003	I1:3	Meat	ICA	12	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	14.4	<5.0
K1100005	H1:3	Meat	Hemköp	11.9	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
K1100007	W1:3	Meat	Willys	13.2	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
K1100009	L1:3	Meat	Lidl	10.5	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	5.93
M1100012	C1:5	Dairy	Coop	3.1	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100014	I1:5	Dairy	ICA	9.42	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100016	H1:5	Dairy	Hemköp	5.34	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100018	W1:5	Dairy	Willys	10.3	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100020	L1:5	Dairy	Lidl	8.74	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100021	C1:7	Fats	Coop	66.2	<2.5	6.94	<2.6	16	<2.5	<2.5	4.34	<2.5	<2.5	88	51.8
M1100023	I1:7	Fats	ICA	67.9	<2.5	8.89	<2.6	16.1	<2.5	<2.5	3.24	<2.5	<2.5	81	8.4
M1100025	H1:7	Fats	Hemköp	72	<2.5	10.4	<2.6	14.5	2.71	<2.5	3.37	<2.5	<2.5	53.9	23.9
M1100027	W1:7	Fats	Willys	70.4	<2.5	6.24	<2.6	14	<2.5	<2.5	3.29	<2.5	<2.5	66.3	17.5
M1100029	L1:7	Fats	Lidl	67.8	<2.5	6.06	<2.6	11.6	<2.5	<2.5	<2.5	<2.5	<2.5	248	16.7

Annex F.
Table 2b. Levels of PBDE and HBCD in food homogenates of selected low price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	BDE-28	BDE-47	BDE-66	BDE-99	BDE-100	BDE-138	BDE-153	BDE-154	BDE-183	BDE-209	HBCD
E1100027	C2:6	Eggs	Coop	10.5	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
E1100029	I2:6	Eggs	ICA	11.3	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	24.1	<5.0
E1100031	H2:6	Eggs	Hemköp	11.6	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	24.8	<5.0
E1100033	W2:6	Eggs	Willys	10.4	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
F1100264	C2:4	Fish	Coop	12.5	10.8	150	27.7	25.8	36.2	<2.5	6.84	19.9	<2.5	60.8	133
F1100266	I2:4	Fish	ICA	10.2	7.13	131	31.8	33	39.1	<2.5	7.33	21.7	<2.5	22.3	209
F1100268	H2:4	Fish	Hemköp	12.2	9.49	138	21.2	23.7	32.6	<2.5	5.15	16.7	<2.5	<14	147
F1100270	W2:4	Fish	Willys	12.5	9.14	147	21	35.2	37.3	<2.5	9.42	24.9	<2.5	<14	254
K1100002	C2:3	Meat	Coop	11.6	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
K1100004	I2:3	Meat	ICA	13.5	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	5.54
K1100006	H2:3	Meat	Hemköp	10.7	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	19.4	5.04
K1100008	W2:3	Meat	Willys	13.2	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	38.3	<5.0
M1100013	C2:5	Dairy	Coop	5.63	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100015	I2:5	Dairy	ICA	6.32	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100017	H2:5	Dairy	Hemköp	6.43	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100019	W2:5	Dairy	Willys	8.01	<2.5	<5.4	<2.6	<5.9	<2.5	<2.5	<2.5	<2.5	<2.5	<14	<5.0
M1100022	C2:7	Fats	Coop	62.7	<2.5	11.3	<2.6	18.5	2.55	<2.5	4.33	<2.5	7.81	83.2	47.4
M1100024	I2:7	Fats	ICA	70	<2.5	<5.4	<2.6	12.1	<2.5	<2.5	<2.5	<2.5	<2.5	50.8	17.1
M1100026	H2:7	Fats	Hemköp	65.2	<2.5	<5.4	<2.6	10.7	<2.5	<2.5	<2.5	<2.5	<2.5	94.8	5.79
M1100028	W2:7	Fats	Willys	67.3	<2.5	5.56	<2.6	13	<2.5	<2.5	3.05	<2.5	<2.5	37.4	16.6

Annex F.

Table 3a. Levels of indicator PCB (I-PCB) in food homogenates of selected standard price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	CB-28	CB-52	CB-101	CB-138	CB-153	CB-180
E1100026	C1:6	Eggs	Coop	9.44	7	2.5	3.1	10.8	12	6.6
E1100028	I1:6	Eggs	ICA	7.99	4.9	1.6	<2.5	10.8	11.7	7.8
E1100030	H1:6	Eggs	Hemköp	8.9	11.8	1.6	3.4	44.6	57.4	18.2
E1100032	W1:6	Eggs	Willys	9.78	4.7	2	4	11.2	11.5	7.4
E1100034	L1:6	Eggs	Lidl	9.03	5.2	1.2	3.3	40	44.8	36
F1100263	C1:4	Fish	Coop	10.7	169	275	668	911	1360	361
F1100265	I1:4	Fish	ICA	11.7	179	269	596	801	1140	304
F1100267	H1:4	Fish	Hemköp	9.96	159	245	595	814	1120	267
F1100269	W1:4	Fish	Willys	8.6	149	235	537	718	1030	257
F1100271	L1:4	Fish	Lidl	14.2	159	268	481	558	783	198
K1100001	C1:3	Meat	Coop	13.0	14.7	7.5	10	57.6	68.6	29.6
K1100003	I1:3	Meat	ICA	11.7	7.8	4.4	6.3	74.8	90.2	39.4
K1100005	H1:3	Meat	Hemköp	12.6	15.8	12	17.1	114	129	80.6
K1100007	W1:3	Meat	Willys	10.7	11	8.5	7.5	68.7	77.6	39.4
K1100009	L1:3	Meat	Lidl	10.5	8.3	4.8	5.5	46.6	52.4	24.9
M1100012	C1:5	Dairy	Coop	5.24	2.3	0.89	1.5	23.4	26.1	11.2
M1100014	I1:5	Dairy	ICA	4.49	2.2	0.85	1.4	14.3	17.8	7.59
M1100016	H1:5	Dairy	Hemköp	4.22	2.5	1.3	1.4	16.4	18.5	7.51
M1100018	W1:5	Dairy	Willys	5.26	<1.3	<0.5	<1.3	22.6	26.8	10.8
M1100020	L1:5	Dairy	Lidl	4.87	1.2	1.7	<1.2	34.7	40.1	17.5
M1100021	C1:7	Fats	Coop	73.4	2.1	2.1	<2.7	54	67	27
M1100023	I1:7	Fats	ICA	68.0	<2.0	1.8	<3	43	57	23
M1100025	H1:7	Fats	Hemköp	73.6	2.4	<1	<2.6	86.1	116	52
M1100027	W1:7	Fats	Willys	74.0	<2.0	<1	<2.7	45	59	24
M1100029	L1:7	Fats	Lidl	68.6	3.4	2.1	<2.7	80.9	108	50

Annex F.
Table 3b. Levels of indicator PCB (I-PCB) in food homogenates of selected low price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	CB-28	CB-52	CB-101	CB-138	CB-153	CB-180
E1100027	C2:6	Eggs	Coop	8.36	16.1	3.4	3.6	1370	1830	490
E1100029	I2:6	Eggs	ICA	9.15	4.9	1.2	<2.5	10.1	11.9	6.5
E1100031	H2:6	Eggs	Hemköp	7.41	7.93	2.1	3	10.7	11.3	6.5
E1100033	W2:6	Eggs	Willys	10.4	8.8	4.2	23.3	261	328	413
F1100264	C2:4	Fish	Coop	12.8	182	300	574	764	1090	298
F1100266	I2:4	Fish	ICA	10.6	137	197	504	788	1160	297
F1100268	H2:4	Fish	Hemköp	12.6	161	220	531	830	1160	256
F1100270	W2:4	Fish	Willys	12.8	198	280	653	936	1310	312
K1100002	C2:3	Meat	Coop	12.1	14.4	6.2	7.1	31.3	38.4	17.8
K1100004	I2:3	Meat	ICA	12.4	12.4	7.9	6.2	52	60	27.8
K1100006	H2:3	Meat	Hemköp	10.9	11	6.5	7.3	28.4	37.5	16.7
K1100008	W2:3	Meat	Willys	10.5	12.6	6.7	8.7	18.5	25.3	8.6
M1100013	C2:5	Dairy	Coop	4.81	2.3	0.82	1.4	21.1	22.8	10.1
M1100015	I2:5	Dairy	ICA	4.58	<1.1	<0.5	<1.1	13.7	15.8	6.14
M1100017	H2:5	Dairy	Hemköp	5.12	2	0.87	1.4	22.5	26.6	11.1
M1100019	W2:5	Dairy	Willys	4.21	1.3	1.4	<1.0	16	18.7	8.13
M1100022	C2:7	Fats	Coop	69.1	<2.0	2.2	4.6	39	48	25
M1100024	I2:7	Fats	ICA	69.6	<2.0	<1.5	<2.7	53	71	30
M1100026	H2:7	Fats	Hemköp	70.4	<2.0	<1.5	<2.7	32	46	19
M1100028	W2:7	Fats	Willys	70.1	2.2	2	<2.7	27	35	14

Annex F.

Table 4a. Levels of non dioxin-like PCB (NDL-PCB) in food homogenates of selected standard price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	CB-66	CB-74	CB-99	CB-110	CB-128	CB-141	CB-170	CB-183	CB-187	CB-194
E1100026	C1:6	Eggs	Coop	9.44	4.3	2.6	1.9	2.5	1.2	1.7	3	1.9	3	0.6
E1100028	I1:6	Eggs	ICA	7.99	2.3	1.5	1.4	<1.9	1.1	<1.4	3.9	2	2.9	0.88
E1100030	H1:6	Eggs	Hemköp	8.9	8.2	6.4	13.5	3.4	5.9	2	8.5	4.8	12.7	1.7
E1100032	W1:6	Eggs	Willys	9.78	2.5	1.7	2.3	2.7	1.3	1.9	3.9	1.9	2.8	0.87
E1100034	L1:6	Eggs	Lidl	9.03	2.8	2	2.3	2.9	4.2	3.3	18.8	8.2	13.4	5
F1100263	C1:4	Fish	Coop	10.7	163	96	329	413	152	108	128	100	299	33
F1100265	I1:4	Fish	ICA	11.7	153	90	318	373	128	78	111	82	246	33
F1100267	H1:4	Fish	Hemköp	9.96	141	89	273	321	129	80	93	67	207	23
F1100269	W1:4	Fish	Willys	8.6	131	80	262	316	118	74	91	67	220	26
F1100271	L1:4	Fish	Lidl	14.2	121	80	228	234	86	56	68	49	170	16
K1100001	C1:3	Meat	Coop	13.0	4.7	5.6	16.3	5.6	4.7	1.8	15	7.5	4.2	2.3
K1100003	I1:3	Meat	ICA	11.7	3	5.1	14.6	3.5	6.8	1.3	15.2	9.6	3.2	2.9
K1100005	H1:3	Meat	Hemköp	12.6	4.9	5.9	15.4	9.1	9.7	8.6	39.9	17.6	20.5	6.2
K1100007	W1:3	Meat	Willys	10.7	3.3	4.7	13.8	3.5	5.8	1.2	15.5	8.9	2.6	3.2
K1100009	L1:3	Meat	Lidl	10.5	2.6	4.3	12.9	2.8	5.1	1	10	5.5	3.2	2.7
M1100012	C1:5	Dairy	Coop	5.24	1.3	2.5	5.24	0.94	2.4	<0.68	5.1	3.1	0.94	0.79
M1100014	I1:5	Dairy	ICA	4.49	0.85	1.6	4.4	0.85	1.5	<0.54	3.6	2	0.81	0.54
M1100016	H1:5	Dairy	Hemköp	4.22	0.93	1.8	3.6	0.8	1.7	<0.51	3.7	2	0.63	0.55
M1100018	W1:5	Dairy	Willys	5.26	0.84	2.2	6.63	<0.79	2.2	<0.68	5.26	2.9	<0.68	0.74
M1100020	L1:5	Dairy	Lidl	4.87	1.5	3.6	8.62	<0.73	3.1	<0.58	8.33	4.1	0.83	1.3
M1100021	C1:7	Fats	Coop	73.4	3.2	7	16	2.9	5.9	1.3	14	6.4	2.3	2.1
M1100023	I1:7	Fats	ICA	68.0	1.8	4.7	11	<1.8	5	1.1	12	5.2	1.1	1.5
M1100025	H1:7	Fats	Hemköp	73.6	4	9.6	21	1.9	10	1.3	26	10	2.9	4.3
M1100027	W1:7	Fats	Willys	74.0	2.4	5.3	13	<1.8	5.6	0.89	13	5	1.3	1.9
M1100029	L1:7	Fats	Lidl	68.6	3.8	7.5	16	3	8.9	1.2	26	8.2	2.1	3.5

Annex F.

Table 4b. Levels of non dioxin-like PCB (NDL-PCB) in food homogenates of selected low price market basket food groups. Values are given in pg/g fresh weight and values below the limit of quantification are given as <LOQ value.

SampleID	OriginID	Matrix	Grocery chain	Fat (%)	CB-66	CB-74	CB-99	CB-110	CB-128	CB-141	CB-170	CB-183	CB-187	CB-194
E1100027	C2:6	Eggs	Coop	8.36	7.5	7	25.2	2.7	80.3	2.3	235	182	257	12.3
E1100029	I2:6	Eggs	ICA	9.15	2.4	1.6	1.6	2	1.2	<1.4	3	1.8	2.6	0.59
E1100031	H2:6	Eggs	Hemköp	7.41	3	1.9	1.9	2.3	1.3	<1.3	3.4	1.6	2.4	0.71
E1100033	W2:6	Eggs	Willys	10.4	5.9	3.4	4.7	18	23.6	36.2	207	76.3	116	72.3
F1100264	C2:4	Fish	Coop	12.8	155	93	306	366	119	91	109	73	217	28
F1100266	I2:4	Fish	ICA	10.6	112	71	247	298	123	82	101	72	224	26
F1100268	H2:4	Fish	Hemköp	12.6	132	77	276	313	132	69	89	70	247	24
F1100270	W2:4	Fish	Willys	12.8	155	97	295	380	142	99	110	78	245	24
K1100002	C2:3	Meat	Coop	12.1	3.3	3.3	9.1	4.1	2.9	1.7	8.2	4.2	4.4	1.6
K1100004	I2:3	Meat	ICA	12.4	3.3	4.6	12	3.2	5.3	1.2	11	6.4	4.5	2.6
K1100006	H2:3	Meat	Hemköp	10.9	3.2	3.6	8.2	3.8	3.1	1.2	8.3	4.4	4.6	1.6
K1100008	W2:3	Meat	Willys	10.5	3.5	3.3	7.6	4.6	2.1	1.2	3.4	2.2	2.6	0.92
M1100013	C2:5	Dairy	Coop	4.81	0.96	1.9	4.1	0.96	2.1	0.67	4.95	2.6	0.96	0.72
M1100015	I2:5	Dairy	ICA	4.58	0.64	1.5	3.5	<0.69	1.4	<0.55	2.8	1.6	<0.6	0.5
M1100017	H2:5	Dairy	Hemköp	5.12	1	2.4	6.86	0.87	2.2	<0.67	5.43	2.8	0.92	0.87
M1100019	W2:5	Dairy	Willys	4.21	0.72	1.6	4.5	<0.63	1.6	<0.51	4	2.1	0.63	0.63
M1100022	C2:7	Fats	Coop	69.1	3.3	5.6	12	5	5	3.2	13	5.5	2.9	2.7
M1100024	I2:7	Fats	ICA	69.6	2	4.7	11	<1.7	5.8	<0.84	15	6	1	2.2
M1100026	H2:7	Fats	Hemköp	70.4	2.5	5	12	<1.8	4.2	0.84	9.9	4.4	1.3	1.5
M1100028	W2:7	Fats	Willys	70.1	2.6	5.5	13	1.8	3.7	1.3	7	2.2	0.77	1.3

Annex F.

Table 5a. Levels of dioxin and dioxin-like PCB in food homogenates of selected market basket food groups. Levels are presented as lower bound (<LOQ=0, LB), medium bound (<LOQ=1/2 LOQ, MB) and upper bound (<LOQ=LOQ, UB) and are give in pg TEQ WHO 1998 /g fresh weight.

SampleID	OriginID	Matrix	Grocery chain	Notes	Fat (%)	∑ PCDD/F LB	∑ PCDD/F MB	∑ PCDD/F UB	∑ PCB LB	∑ PCB MB	∑ PCB UB
E1100026	C1:6	Eggs	Coop	Standard price	9.44	0.033	0.041	0.049	0.0014	0.0023	0.0031
E1100028	I1:6	Eggs	ICA	Standard price	7.99	0.035	0.042	0.049	0.0019	0.0028	0.0037
E1100030	H1:6	Eggs	Hemköp	Standard price	8.9	0.029	0.051	0.073	0.019	0.019	0.019
E1100032	W1:6	Eggs	Willys	Standard price	9.78	0.024	0.033	0.041	0.0047	0.0048	0.0048
E1100034	L1:6	Eggs	Lidl	Standard price	9.03	0.026	0.033	0.039	0.014	0.014	0.014
F1100263	C1:4	Fish	Coop	Standard price	10.7	0.18	0.19	0.21	0.36	0.36	0.36
F1100265	I1:4	Fish	ICA	Standard price	11.7	0.14	0.16	0.17	0.31	0.31	0.31
F1100267	H1:4	Fish	Hemköp	Standard price	9.96	0.25	0.25	0.25	0.34	0.34	0.34
F1100269	W1:4	Fish	Willys	Standard price	8.6	0.19	0.19	0.19	0.3	0.3	0.3
F1100271	L1:4	Fish	Lidl	Standard price	14.2	0.082	0.1	0.12	0.23	0.23	0.23
K1100001	C1:3	Meat	Coop	Standard price	13.0	0.012	0.015	0.017	0.023	0.023	0.023
K1100003	I1:3	Meat	ICA	Standard price	11.7	0.038	0.041	0.043	0.03	0.03	0.03
K1100005	H1:3	Meat	Hemköp	Standard price	12.6	0.0098	0.015	0.019	0.028	0.028	0.028
K1100007	W1:3	Meat	Willys	Standard price	10.7	0.011	0.013	0.016	0.038	0.038	0.038
K1100009	L1:3	Meat	Lidl	Standard price	10.5	0.012	0.015	0.018	0.021	0.021	0.021
M1100012	C1:5	Dairy	Coop	Standard price	5.24	0.0082	0.011	0.015	0.013	0.013	0.013
M1100014	I1:5	Dairy	ICA	Standard price	4.49	0.0027	0.0074	0.012	0.0082	0.0082	0.0082
M1100016	H1:5	Dairy	Hemköp	Standard price	4.22	0.0057	0.0089	0.012	0.01	0.01	0.01
M1100018	W1:5	Dairy	Willys	Standard price	5.26	0.0063	0.0095	0.013	0.014	0.014	0.014
M1100020	L1:5	Dairy	Lidl	Standard price	4.87	0.0098	0.013	0.016	0.016	0.016	0.016
M1100021	C1:7	Fats	Coop	Standard price	73.4	0.00082	0.067	0.13	0.034	0.034	0.034
M1100023	I1:7	Fats	ICA	Standard price	68.0	0.00014	0.064	0.13	0.028	0.028	0.028
M1100025	H1:7	Fats	Hemköp	Standard price	73.6	0.00011	0.063	0.13	0.045	0.045	0.045
M1100027	W1:7	Fats	Willys	Standard price	74.0	0.00013	0.074	0.15	0.03	0.03	0.03
M1100029	L1:7	Fats	Lidl	Standard price	68.6	0.000078	0.064	0.13	0.041	0.041	0.042

Annex F.

Table 5b. Levels of dioxin and dioxin-like PCB in food homogenates of selected market basket food groups. Levels are presented as lower bound (<LOQ=0, LB), medium bound (<LOQ=1/2 LOQ, MB) and upper bound (<LOQ=LOQ, UB) and are give in pg TEQ WHO 2005 /g fresh weight.

SampleID	OriginID	Matrix	Grocery chain	Notes	Fat (%)	∑ PCDD/F LB	∑ PCDD/F MB	∑ PCDD/F UB	∑ PCB LB	∑ PCB MB	∑ PCB UB
E1100026	C1:6	Eggs	Coop	Standard price	9.44	0.032	0.039	0.047	0.00052	0.0014	0.0022
E1100028	I1:6	Eggs	ICA	Standard price	7.99	0.034	0.04	0.047	0.0022	0.0031	0.004
E1100030	H1:6	Eggs	Hemköp	Standard price	8.9	0.029	0.05	0.071	0.015	0.015	0.015
E1100032	W1:6	Eggs	Willys	Standard price	9.78	0.023	0.032	0.04	0.0038	0.0038	0.0038
E1100034	L1:6	Eggs	Lidl	Standard price	9.03	0.024	0.031	0.038	0.012	0.012	0.012
F1100263	C1:4	Fish	Coop	Standard price	10.7	0.14	0.15	0.17	0.28	0.28	0.28
F1100265	I1:4	Fish	ICA	Standard price	11.7	0.11	0.12	0.14	0.24	0.24	0.24
F1100267	H1:4	Fish	Hemköp	Standard price	9.96	0.19	0.19	0.19	0.27	0.27	0.27
F1100269	W1:4	Fish	Willys	Standard price	8.6	0.15	0.15	0.15	0.23	0.23	0.23
F1100271	L1:4	Fish	Lidl	Standard price	14.2	0.064	0.085	0.11	0.18	0.18	0.18
K1100001	C1:3	Meat	Coop	Standard price	13.0	0.01	0.013	0.015	0.02	0.02	0.02
K1100003	I1:3	Meat	ICA	Standard price	11.7	0.034	0.036	0.038	0.026	0.026	0.026
K1100005	H1:3	Meat	Hemköp	Standard price	12.6	0.008	0.013	0.017	0.021	0.021	0.021
K1100007	W1:3	Meat	Willys	Standard price	10.7	0.0094	0.012	0.014	0.033	0.033	0.033
K1100009	L1:3	Meat	Lidl	Standard price	10.5	0.01	0.013	0.016	0.017	0.017	0.017
M1100012	C1:5	Dairy	Coop	Standard price	5.24	0.0071	0.01	0.014	0.012	0.012	0.012
M1100014	I1:5	Dairy	ICA	Standard price	4.49	0.0016	0.0063	0.011	0.0072	0.0072	0.0072
M1100016	H1:5	Dairy	Hemköp	Standard price	4.22	0.0047	0.0079	0.011	0.0092	0.0092	0.0092
M1100018	W1:5	Dairy	Willys	Standard price	5.26	0.0049	0.008	0.011	0.012	0.012	0.012
M1100020	L1:5	Dairy	Lidl	Standard price	4.87	0.008	0.011	0.014	0.013	0.013	0.013
M1100021	C1:7	Fats	Coop	Standard price	73.4	0.0011	0.063	0.13	0.03	0.03	0.03
M1100023	I1:7	Fats	ICA	Standard price	68.0	0.00043	0.06	0.12	0.026	0.026	0.026
M1100025	H1:7	Fats	Hemköp	Standard price	73.6	0.00033	0.059	0.12	0.039	0.039	0.039
M1100027	W1:7	Fats	Willys	Standard price	74.0	0.0004	0.07	0.14	0.027	0.027	0.027
M1100029	L1:7	Fats	Lidl	Standard price	68.6	0.00023	0.059	0.12	0.037	0.037	0.037

Annex F.

Table 5c. Levels of dioxin and dioxin-like PCB in food homogenates of selected market basket food groups. Levels are presented as lower bound (<LOQ=0, LB), medium bound (<LOQ=1/2 LOQ, MB) and upper bound (<LOQ=LOQ, UB) and are give in pg TEQ WHO 1998 /g fresh weight.

SampleID	OriginID	Matrix	Grocery chain	Notes	Fat (%)	∑ PCDD/F LB	∑ PCDD/F MB	∑ PCDD/F UB	∑ PCB LB	∑ PCB MB	∑ PCB UB
E1100027	C2:6	Eggs	Coop	Low price	8.36	0.045	0.053	0.061	0.11	0.11	0.11
E1100029	I2:6	Eggs	ICA	Low price	9.15	0.032	0.04	0.048	0.0051	0.0051	0.0052
E1100031	H2:6	Eggs	Hemköp	Low price	7.41	0.035	0.052	0.07	0.015	0.015	0.015
E1100033	W2:6	Eggs	Willys	Low price	10.4	0.041	0.047	0.054	0.039	0.039	0.039
F1100264	C2:4	Fish	Coop	Low price	12.8	0.13	0.14	0.14	0.3	0.3	0.3
F1100266	I2:4	Fish	ICA	Low price	10.6	0.24	0.24	0.24	0.3	0.3	0.3
F1100268	H2:4	Fish	Hemköp	Low price	12.6	0.18	0.18	0.19	0.3	0.3	0.3
F1100270	W2:4	Fish	Willys	Low price	12.8	0.27	0.27	0.27	0.39	0.39	0.39
K1100002	C2:3	Meat	Coop	Low price	12.1	0.009	0.013	0.017	0.01	0.011	0.011
K1100004	I2:3	Meat	ICA	Low price	12.4	0.0065	0.011	0.016	0.018	0.018	0.018
K1100006	H2:3	Meat	Hemköp	Low price	10.9	0.0074	0.011	0.014	0.01	0.01	0.01
K1100008	W2:3	Meat	Willys	Low price	10.5	0.0098	0.013	0.017	0.0071	0.0071	0.0071
M1100013	C2:5	Dairy	Coop	Low price	4.81	0.0045	0.0072	0.01	0.0096	0.0096	0.0096
M1100015	I2:5	Dairy	ICA	Low price	4.58	0.0056	0.0085	0.011	0.0075	0.0075	0.0075
M1100017	H2:5	Dairy	Hemköp	Low price	5.12	0.0059	0.0092	0.013	0.011	0.011	0.011
M1100019	W2:5	Dairy	Willys	Low price	4.21	0.0074	0.01	0.013	0.0086	0.0086	0.0086
M1100022	C2:7	Fats	Coop	Low price	69.1	0.00013	0.078	0.16	0.024	0.024	0.024
M1100024	I2:7	Fats	ICA	Low price	69.6	0.00014	0.066	0.13	0.033	0.033	0.033
M1100026	H2:7	Fats	Hemköp	Low price	70.4	0.00013	0.064	0.13	0.023	0.023	0.023
M1100028	W2:7	Fats	Willys	Low price	70.1	0.00012	0.066	0.13	0.0029	0.0095	0.016

Annex F.
Table 5d. Levels of dioxin and dioxin-like PCB in food homogenates of selected market basket food groups. Levels are presented as lower bound (<LOQ=0, LB), medium bound (<LOQ=1/2 LOQ, MB) and upper bound (<LOQ=LOQ, UB) and are give in pg TEQ WHO 2005 /g fresh weight.

SampleID	OriginID	Matrix	Grocery chain	Notes	Fat (%)	∑ PCDD/F LB	∑ PCDD/F MB	∑ PCDD/F UB	∑ PCB LB	∑ PCB MB	∑ PCB UB
E1100027	C2:6	Eggs	Coop	Low price	8.36	0.04	0.048	0.057	0.031	0.031	0.031
E1100029	I2:6	Eggs	ICA	Low price	9.15	0.03	0.038	0.047	0.0044	0.0044	0.0044
E1100031	H2:6	Eggs	Hemköp	Low price	7.41	0.034	0.051	0.068	0.014	0.014	0.014
E1100033	W2:6	Eggs	Willys	Low price	10.4	0.038	0.045	0.051	0.018	0.018	0.018
F1100264	C2:4	Fish	Coop	Low price	12.8	0.11	0.11	0.12	0.23	0.23	0.23
F1100266	I2:4	Fish	ICA	Low price	10.6	0.19	0.19	0.19	0.24	0.24	0.24
F1100268	H2:4	Fish	Hemköp	Low price	12.6	0.15	0.15	0.15	0.24	0.24	0.24
F1100270	W2:4	Fish	Willys	Low price	12.8	0.21	0.21	0.22	0.31	0.31	0.31
K1100002	C2:3	Meat	Coop	Low price	12.1	0.008	0.012	0.016	0.0085	0.0085	0.0085
K1100004	I2:3	Meat	ICA	Low price	12.4	0.0055	0.01	0.014	0.014	0.014	0.014
K1100006	H2:3	Meat	Hemköp	Low price	10.9	0.0058	0.0093	0.013	0.0085	0.0085	0.0085
K1100008	W2:3	Meat	Willys	Low price	10.5	0.0079	0.011	0.015	0.0059	0.0059	0.0059
M1100013	C2:5	Dairy	Coop	Low price	4.81	0.0037	0.0064	0.0092	0.0082	0.0082	0.0082
M1100015	I2:5	Dairy	ICA	Low price	4.58	0.0045	0.0074	0.01	0.0065	0.0065	0.0065
M1100017	H2:5	Dairy	Hemköp	Low price	5.12	0.0043	0.0076	0.011	0.0099	0.0099	0.0099
M1100019	W2:5	Dairy	Willys	Low price	4.21	0.0064	0.0092	0.012	0.0075	0.0075	0.0075
M1100022	C2:7	Fats	Coop	Low price	69.1	0.00039	0.074	0.15	0.021	0.021	0.021
M1100024	I2:7	Fats	ICA	Low price	69.6	0.00042	0.062	0.12	0.03	0.03	0.03
M1100026	H2:7	Fats	Hemköp	Low price	70.4	0.00038	0.06	0.12	0.02	0.02	0.02
M1100028	W2:7	Fats	Willys	Low price	70.1	0.00035	0.062	0.12	0.0007	0.0072	0.014

Annex G

Method flow scheme 1

Fruit & Vegetables

Extraction
10 g sample
20 ml EtAc
$NaHCO_3$+Na_2SO_4
Falcon tube
Ultrasonication

↓

Centrifugation

↓

Filtration

↓ ↓

inject GC-MS/MS | **inject** LC-MS/MS

Method flow scheme 2

Cereals

Extraction
5 g sample
10 ml water
10 ml EtAc (1 % Hac)
+ Na_2SO_4
Falcon tube
Ultrasonication

↓

Centrifugation

↓

Filtration

↓ ↓

inject GC-MS/MS | **inject** LC-MS/MS

Method flow scheme 3

Animal origin, low fat

Extraction
5 g sample
PSA + C18 + Na_2SO_4
10 ml EtAc
Falcon tube
Shake board

↓

Centrifugation

↓

Filtration

↓ ↓

inject to GC-MS/MS | **inject** to LC-MS/MS

Annex H. Pesticides analysed and their LOQ:s

Pesticide	LOQ (mg/kg)
Abamectin	0.05
Acephate	0.01
Acetamiprid	0.01
Acetochlor	0.01
Acibenzolar-S-methyl	0.01
Aclonifen	0.01
Acrinathrin	0.01
Aldicarb	0.01
Aldicarb-sulfone	0.01
Aldicarb-sulfoxid	0.01
Aminocarb	0.01
Amitraz	0.01
Aspon	0.01
Atrazine	0.01
Atrazine-desethyl	0.01
Atrazine-desisopropyl	0.01
Azadirachtin	0.01
Azinphos-ethyl	0.01
Azinphos-methyl	0.05
Azoxystrobin	0.01
Benalaxyl	0.01
Bendiocarb	0.01
Benfuracarb	0.01
Bifenthrin	0.01
Binapacryl	0.05
Biphenyl	0.01
Bifenazate	0.01
Bitertanol	0.01
Boscalid	0.01
Bromophos	0.01
Bromophos-ethyl	0.01
Bromopropylate	0.01
Bromuconazole I	0.01
Bromuconazole II	0.01
Bupirimate	0.01
Buprofezin	0.01
Butocarboxim	0.01
Butocarboxim-sulfoxid	0.01
Butoxycarboxim	0.01
Butralin	0.01
Cadusafos	0.01
Carbaryl	0.01
Carbendazim	0.01
Carbofuran	0.01
Carbofuran-3OH	0.01

Pestecide	LOQ(mg/kg)
Carbosulfan	0.01
Carboxim	0.01
Carfentrazone-ethyl	0.01
Chinomethionat	0.01
Chlorantraniliprole	0.01
Chlordane. cis-	0.01
Chlordane. trans-	0.01
Chlordimeform	0.01
Chlorfenapyr	0.01
Chlorfenson	0.01
Chlorfenvinphos	0.01
Chlormephos	0.01
Chloroaniline. 3-	0.01
Chlorobenzilate	0.01
Chlorobromuron	0.01
Chloropropylate	0.01
Chlorothalonil	0.01
Chlorpropham	0.01
Chlorpyrifos	0.01
Chlorpyrifos-methyl	0.01
Chlorpyrifos-O-Analogue	0.01
Chlorthal-dimethyl	0.01
Chlozolinate	0.01
Clofentezine	0.01
Clomazone	0.01
Clothianidin	0.01
Coumaphos	0.01
Cyanazin	0.01
Cyanofenfos	0.01
Cyanofos	0.01
Cyazofamid	0.01
Cyfluthrin (sum)	0.01
Cyfluthrin. beta- (sum)	0.01
Cypermethrin	0.01
Cyproconazole	0.01
Cyprodinil	0.01
Danifos	0.01
DDD. p.p-/DDT. o.p-	LOD=0.01
DDE. p.p-	LOD=0.01
DDT. p.p-	LOD=0.01
DEET	0.01
Deltamethrin 1	0.01
Deltamethrin 2	0.01
Demeton	0.01
Demeton-S-methyl	0.01

Pesticide	LOQ (mg/kg)
Demeton-S-methyl-sulfone	0.01
Demeton-S-methyl-sulfoxid	0.01
Desmethyl pirimicarb	0.01
Desmetryn	0.01
Dialifos	0.01
Diazinon	0.01
Dichlobenil	0.01
Dichlofluanid	0.01
Dichloroaniline. 3.5-	0.01
Dichlorobenzophenone. 2.4`-	LOD=0.01
Dichlorobenzophenone. 4.4`-	LOD=0.01
Dichlorvos	0.01
Dicloran	0.01
Dicrotophos	0.01
Dieldrin	0.01
Diethofencarb	0.01
Difenoconazole	0.01
Dimethoate	0.01
Dimethomorph	0.01
Dimoxystrobin	0.01
Dinobuton	0.01
Dioxathion 1	0.01
Dioxathion 2	0.01
Diphenamid	0.01
Diphenylamine	0.01
Disulfoton	0.01
Disulfoton-Sulfon	0.01
Disulfoton-sulfoxid	0.01
DMF	0.01
DMPF	0.01
DMSA	0.01
DMST	0.01
Endosulfan. alpha-	0.01
Endosulfan. beta-	0.01
Endosulfansulfate	0.01
Endrin	0.01
EPN	0.01
Epoxiconazole	0.01
Esfenvalerate	0.01
Ethiofencarb	0.01
Ethiofencarb-sulfone	0.01
Ethiofencarb-sulfoxid	0.01
Ethion	0.01
Ethofumesate	0.01
Ethoprophos	0.01
Etofenprox	0.01
Etrimfos	0.01

Pesticide	LOQ (mg/kg)
Famoxadone	0.01
Fenamiphos	0.01
Fenamiphos-Sulfon	0.01
Fenamiphos-Sulfoxid	0.01
Fenarimol	0.01
Fenazaquin	0.01
Fenbuconazole	0.01
Fenchlorphos	0.01
Fenhexamid	0.01
Fenitrothion	0.01
Fenoxycarb	0.01
Fenpiclonil	0.01
Fenpropathrin	0.01
Fenpropimorph	0.01
Fenpyroximate	0.01
Fenson	0.01
Fensulfothion	0.01
Fensulfothion-oxon	0.01
Fensulfothion-oxon-sulfone	0.01
Fensulfothion-sulfone	0.01
Fenthion	0.01
Fenthion-oxon	0.01
Fenthion-oxon-sulfone	0.01
Fenthion-oxon-sulfoxide	0.01
Fenthion-sulfon	0.01
Fenthion-sulfoxid	0.01
Fenvalerate 1	0.01
Fenvalerate 2	0.01
Fipronil	0.01
Fipronil sulfone	0.01
Fluacrypyrim	0.01
Fluazifop-P-butyl	0.01
Fluazinam	0.05
Fludioxonil	0.01
Flumetralin	0.01
Fluquinconazole	0.01
Flurochloridone	0.01
Flusilazole	0.01
Flutriafol	0.01
Fonofos	0.01
Formetanate	0.01
Formothion	0.01
Fosthiazate 1+2	0.01
Ftalimid	LOD=0.01
Furalaxyl	0.01
Furathiocarb	0.01
Haloxyfop	0.01

Pesticide	LOQ (mg/kg)
Haloxyfop-Ethoxyethylester	0.01
Haloxyfop-Methyl	0.01
HCH. alpha-	0.01
HCH. beta-	0.01
HCH. delta-	0.01
HCH. gamma-	0.01
Heptachlor	0.01
Heptachlor epoxide	0.01
Heptenophos	0.01
Hexachlorobenzene	0.01
Hexaconazole	0.01
Hexazinone	0.01
Hexythiazox	0.01
Imazalil	0.01
Imidacloprid	0.01
Indoxacarb	0.01
Iprodione	0.01
Iprovalicarb	0.01
Isasofos	0.01
Isofenphos	0.01
Isofenphos-methyl	0.01
Isoprocarb	0.01
Isopropalin	0.01
Isoproturon	0.01
Isoxaben	0.01
Jodfenphos	0.01
Kresoxim-methyl	0.01
Kvinoxyfen	0.01
Lambda-Cyhalothrin 2	0.01
Leptophos	0.01
Linuron	0.01
Malaoxon	0.01
Malathion	0.01
Mecarbam	0.01
Mepanipyrim	0.01
Mepanipyrim. hydroxypropyl-	0.01
Mephosfolan	0.01
Metaflumizone	0.01
Metalaxyl	0.01
Metazachlor	0.01
Metconazole	0.01
Methabenzthiazuron	0.01
Methamidophos	0.01
Methiocarb	0.01
Methiocarb-sulfon	0.01
Methiocarb-sulfoxid	0.01
Methomyl	0.01

Pesticide	LOQ (mg/kg)
Methoxychlor	0.01
Methoxyfenozide	0.01
Metidathion	0.01
Metribuzin	0.01
Mevinphos	0.01
Monocrotophos	0.01
Myclobutanil	0.01
Napropamide	0.01
Nitenpyram	0.01
Nitrofen	0.01
Ofurace	0.01
Omethoate	0.01
Orthophenylphenol	0.01
Oxadixyl	0.01
Oxamyl	0.01
Oxamyl-Oxime	0.01
Paclobutrazol	0.01
Paraoxon	0.01
Paraoxon-Methyl	0.01
Parathion	0.01
Parathion-methyl	0.01
Penconazole	0.01
Pencycuron	0.01
Pendimethalin	0.01
Pentachloroaniline	0.01
Pentachloroanisole	0.01
Pentachlorobenzene	0.01
Permethrin	0.01
Phenmedipham	0.01
Phenothrin	0.01
Phenthoate	0.01
Phorate	0.01
Phorate-O-Analogue	0.01
Phorate-Sulfon	0.01
Phorate-Sulfoxid	0.01
Phosalone	0.01
Phosmet	0.01
Phosmet oxon	0.05
Phosphamidon	0.01
Phoxim	0.01
Picoxystrobin	0.01
Piperonyl Butoxide	0.01
Pirimicarb	0.01
Pirimiphos-Ethyl	0.01
Pirimiphos-methyl	0.01
Prochloraz	0.01
Procymidone	0.01

Pesticide	LOQ (mg/kg)
Profenofos	0.01
Promecarb	0.01
Prometryn	0.01
Propamocarb	0.01
Propanil	0.01
Propaquizafop	0.01
Propargite (1+2)	0.01
Propetamphos	0.01
Propham	0.01
Propiconazole	0.01
Propoxur	0.01
Propyzamide	0.01
Prosulfocarb	0.01
Prothioconazole-desthio	0.01
Pymetrozine	0.01
Pyraclofos	0.01
Pyraclostrobin	0.01
Pyrazophos	0.01
Pyridaben	0.01
Pyrethrins. Cinerin I	0.05
Pyrethrins. Cinerin II	0.05
Pyrethrins. Jasmolin I	0.05
Pyrethrins. Jasmolin II	0.05
Pyrethrins. Pyrethrin I	0.01
Pyrethrins. Pyrethrin II	0.01
Pyridaphenthion	0.01
Pyrifenox	0.01
Pyrimethanil	0.01
Pyriproxyfen	0.01
Quinalphos	0.01
Quintozene	0.01
Quizalofop	0.01
Rotenone	0.01
Simazine	0.01
Spinosyn A	0.01
Spinosyn D	0.01
Spiromesifen	0.01
Spiroxamine	0.01
Sulfentrazone	0.01
Sulfotep	0.01
TCNB. 2.3.4.5-	0.01
Tebuconazole	0.01
Tebufenozide	0.01
Tebufenpyrad	0.01
Tecnazene	0.01
Teflubenzuron	0.01
Tefluthrin	0.01

Pesticide	LOQ (mg/kg)
TEPP	0.01
Tepraloxydim	0.01
Terbufos	0.01
Terbufos Sulfone	0.01
Terbufos Sulfoxide	0.01
Terbufos-O-sulfone	0.01
Terbufos-oxon	0.01
Terbufos-oxon-sulphoxid	0.01
Terbuthylazine	0.01
Terbutryn	0.01
Tetrachloranilin. 2.3.5.6-	0.01
Tetrachlorvinphos	0.01
Tetraconazole	0.01
Tetradifon	0.01
Tetrahydroftalimid	LOD=0.01
Tetrasul	0.01
Thiabendazole	0.01
Thiacloprid	0.01
Thiametoxam	0.01
Thiodicarb	0.01
Thiometon	0.01
Thiometon-sulfone	0.01
Thiometon-sulfoxide	0.01
Thionazin	0.01
Thiophanate-methyl	LOD=0.01
Tolclofos-methyl	0.01
Tolylfluanid	0.01
Triadimefon	0.01
Triadimenol	0.01
Triamiphos	0.01
Triazamate	0.01
Triazofos	0.01
Tribromoanisole. 2.4.6-	0.01
Tribromophenol. 2.4.6-	0.01
Trichlorfon	0.01
Trichloronat	0.01
Trichlorophenol. 2.4.6-	0.01
Trifloxystrobin	0.01
Triflumizole	0.01
Trimethacarb. 2.3.5-	0.01
Trimethacarb. 3.4.5-	0.01
Triticonazole	0.01
Vamidothion	0.01
Vamidothion-sulfoxide	0.01
Vinclozolin	0.01
Zoxamide	0.01

Annex I - LC

mg/Kg (ppb) **Enbart F&G**

	Prov ID	Propamokarb	Tiabendazol	Pirimikarb	Imazalil	Fosmetoxon	Fludixonil	Fenhexamid	Boskalid		
	I1:8										
	C2:8										
	I2:8										
	H1:8										
	H2:8										
	L1:8										
	L1H:8										
	W2:8	0.01									
	W1:8	0.011									
	W1H:8										
	H1H:8										
	C1:8										
	I1H:8										
	C1H:8	0.047									
	I1:9		0.033								
	C2:9		0.018		0.012				0.011		
	I2:9		0.017		0.012						
	H1:9					0.011					
	H2:9		0.017	0.016			0.025		0.013		
	L1:9										
	L1H:9							0.016			
	W2:9				0.018						
	W1:9		0.099		0.01						
	W1H:9				0,014				0.017		
	H1H:9		0.019		0.012				0.016		
	C1:9										
	I1H:9		0.013		0.036						
	C1H:9		0.017		0.012						
Träffar	n	3	8	1	8	1	1	1	4	27	Tot

Annex I - GC

		mg/Kg (ppb)		**Enbart F&G**							
	Prov ID	**Difenylamin**	**Pyrimetanil**								
	I1:8		(0.001)								
	C2:8										
	I2:8		(0.002)								
	H1:8										
	H2:8										
	L1:8										
	L1H:8		(0.002)								
	W2:8										
	W1:8										
	W1H:8										
	H1H:8										
	C1:8		(0.001)								
	I1H:8										
	C1H:8										
	I1:9	(0.002)	0.011								
	C2:9										
	I2:9										
	H1:9		(0.004)								
	H2:9		(0.006)								
	L1:9		(0.004)								
	L1H:9		(0.004)								
	W2:9		(0.002)								
	W1:9										
	W1H:9										
	H1H:9										
	C1:9		(0.003)								
	I1H:9										
	C1H:9										
Träffar	n		1							1	Tot
< 0.01	n	1	10							11	

Annex I - total results

Sample ID's and found concentrations of pesticides in fruit and vegetables (mg/kg) (pesticides were not found in other sample types). Concentrations below LOQ are presented within parentheses.

Sample ID	Sample type	Propamocarb	Thiabendazole	Pirimicarb	Imazalil	Phosmet oxon	Fludioxonil	Fenhexamid	Boscalid	Diphenylamine	Pyrimethanil
I1:8	Vegetables										(0.001)
C2:8											
I2:8											
H1:8											
H2:8											
L1:8											
L1H:8											(0.002)
W2:8		0.010									
W1:8		0.011									
W1H:8											
H1H:8											
C1:8											
I1H:8											
C1H:8		0.047									
I1:9	Fruit		0.033							(0.002)	0.011
C2:9			0.018		0.012				0.011		
I2:9			0.017		0.012						
H1:9						(0.011)*					(0.004)
H2:9			0.017	0.016			0.025		0.013		(0.006)
L1:9											(0.004)
L1H:9								0.016			(0.004)
W2:9					0.018						(0.002)
W1:9			0.099		0.010						
W1H:9					0.014				0.017		
H1H:9			0.019		0.012				0.016		
C1:9											(0.003)
I1H:9			0.013		0.036						
C1H:9			0.017		0.012						

*LOQ=0.05 mg/kg

Annex J

PAH levels (µg/kg) in the twelve food groups sampled in 2010 compared to samples from 1999.

	Cereal products			Pastries			Meat			Fish		Dairy prod.		Eggs		Fats			Vegetables			Fruits			Potatoes		Sugar, sweets			Bev.
PAHs	s-p	l-p	1999	s-p	l-p	1999	s-p	l-p	1999	s-p	l-p	s-p	l-p	s-p	l-p	s-p	l-p	1999	s-p	l-p	1999	s-p	l-p	1999	s-p	l-p	s-p	l-p	1999	s-p
Phe	0.37	0.45	0.73	0.55	0.53	2.81	0.54	2.48	4.07	0.46	0.74	n.d.	0.16	2.03	0.07	0.87	0.67	0.11	n.d.	0.17	0.28	0.15	1.32	2.10	n.d.	n.d.	1.52	1.81	1.89	0.24
Ant	0.03	0.05	0.05	0.05	0.08	0.24	0.14	0.65	0.99	0.08	0.17	n.d.	n.d.	0.17	n.d.	0.05	0.06	0.02	n.d.	n.d.	n.d.	n.d.	0.03	0.03	n.d.	n.d.	0.14	0.18	0.20	n.d.
Flu	0.14	0.12	0.23	0.25	0.28	1.35	0.17	0.92	1.03	0.14	0.26	0.05	0.08	0.26	0.05	0.42	0.50	0.43	0.05	0.08	0.10	0.08	0.54	1.01	n.d.	0.04	0.73	0.86	0.71	n.d.
Pyr	0.16	0.13	0.30	0.30	0.32	1.60	0.23	0.93	1.16	0.09	0.17	0.11	0.11	0.17	0.07	0.58	0.71	0.68	0.04	n.d.	0.10	0.07	0.19	0.29	n.d.	0.08	0.68	0.83	0.67	n.d.
BcL	n.d.	n.d.	n.d.	n.d.	0.03	0.22	n.d.	0.07	0.07	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	0.12	0.13	n.d.
CPP	n.d.	n.d.	0.03	0.05	0.06	0.48	0.03	0.13	0.08	n.d.	n.d.	0.07	0.05	n.d.	0.06	0.05	0.09	0.19	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.06	0.12	0.10	0.11	n.d.
BaA	0.03	n.d.	0.09	0.07	0.07	0.52	0.12	0.12	0.12	0.03	0.03	n.d.	n.d.	n.d.	n.d.	0.15	0.17	0.21	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.14	0.17	0.12	n.d.
TP	n.d.	n.d.	0.04	0.04	0.05	0.29	n.d.	0.03	0.03	0.03	0.04	n.d.	n.d.	n.d.	n.d.	0.09	0.12	0.13	n.d.	n.d.	n.d.	n.d.	n.d.	0.07	n.d.	n.d.	0.06	0.08	0.08	n.d.
CHR	0.04	0.03	0.15	0.09	0.09	0.64	0.09	0.14	0.10	0.03	0.03	n.d.	n.d.	0.03	n.d.	0.21	0.24	0.29	0.05	n.d.	n.d.	0.03	0.03	0.07	n.d.	n.d.	0.18	0.22	0.14	n.d.
5MC	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
BbF	0.04	0.03	0.07	0.07	0.07	0.23	0.03	0.03	0.04	n.d.	n.d.	n.d.	n.d.	0.03	n.d.	0.14	0.15	0.15	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	0.03	0.13	0.18	0.07	n.d.
BkF	n.d.	n.d.	0.03	n.d.	0.03	0.10	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	0.06	0.06	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	0.08	0.03	n.d.
BjF	n.d.	n.d.	0.03	n.d.	0.04	0.15	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.07	0.09	0.09	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.04	0.08	0.04	n.d.
BeP	0.04	0.03	0.07	0.04	0.07	0.27	n.d.	0.03	0.03	n.d.	n.d.	n.d.	n.d.	0.03	n.d.	0.13	0.15	0.15	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	n.d.	n.d.	0.06	0.15	0.06	n.d.
BaP	0.03	n.d.	0.06	0.05	0.05	0.22	0.03	0.03	0.04	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.13	0.12	0.13	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.10	0.14	0.08	n.d.
Per	n.d.	n.d.	n.d.	0.03	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	n.d.	n.d.
DhA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
IcP	n.d.	n.d.	0.04	0.03	0.05	0.10	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.07	0.07	0.10	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	0.10	0.04	n.d.
BgP	0.04	n.d.	0.08	0.08	0.09	0.21	n.d.	0.03	0.03	0.03	n.d.	n.d.	n.d.	0.03	0.03	0.14	0.15	0.20	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.04	0.05	0.13	0.07	n.d.
ATR	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.03	n.d.	n.d.
DlP	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
DeP	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
DiP	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
DhP	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cor	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

s-p = standard-price food market basket from 2010; l-p = low-price food market basket from 2010; 1999 = samples from 1999

n.d. = not detected <LOD=0,03µg/kg

Annex K. Estimated per capita exposure to individual fatty acids in the 2010 market basket survey (g per person per day)

Fatty acid	g/p/d	Fatty acid	g/p/d
SFA		*PUFA*	
C 4:0	0.76	C 16:2 n-4	0.02
C 6:0	0.44	C 16:3	n.d.
C 8:0	1.7	C 16:4 n-3	0.01
C 10:0	1.11	C 18:2	12.0
C 12:0	3.9	C 18:2 cis n-6	11.6
C 13:0	0.02	C 18:2 conj	0.18
C 14:0	5.0	C 18:3 n-3	2.6
C 15:0 i	0.08	C 18:3 n-6	0.01
C 15:0 ai	0.12	C 18:4 n-3	0.08
C 15:0	0.35	C 20:2 n-6	0.05
C 16:0 i	0.06	C 20:3 n-3	0.02
C 16:0 ai	0.01	C 20:3 n-6	0.04
C 16:0	24.9	C 20:4 n-3	0.03
C 17:0 i	0.16	C 20:4 n-6	0.12
C 17:0 ai	0.15	C 20:5 n-3	0.18
C 17:0	0.30	C 21:5 n-3	0.01
C 18:0 i	0.02	C 22:2 n-6	n.d.
C 18:0 ai	n.d.	C 22:4 n-3	n.d.
C 18:0	9.8	C 22:4 n-6	0.01
C 20:0	0.39	C 22:5 n-3	0.06
C 22:0	0.19	C 22:5 n-6	0.01
C 23:0	n.d.	C 22:6 n-3	0.33
C 24:0	0.06		
MUFA		*Trans*	1.72
C 14:1	0.31	C 14:1t	0.10
C 15:1	n.d.	C 16:1t	0.15
C 16:1	1.2	C 18:1t	1.03
C 17:1	0.19	C 18:2t	0.33
C 18:1	39.1	C 18:3t	0.11
C 20:1	0.76		
C 22:1	0.47	Other FA	0.13
C 24:1 n-9	0.05	Rest (not defined)	0.49

n.d. = not detected
i = *iso* isomer
ai = *ante-iso* isomer

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