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Per capita-based analyses of nutrients and toxic compounds in market baskets and assessment of benefit or risk

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Preface

This report presents results from the latest Swedish market basket study, the Market Basket 2022. The market basket studies are conducted on regular basis to provide updated concentrations of several compounds, both nutrients and potentially toxic substances, in food groups representative for the average Swedish food consumption. The Market Basket 2022 also gives an overview of the population mean intakes of these compounds in relation to health-based reference values. This provides a basis in the risk and benefit assessments at the Swedish Food Agency and in the agency´s work for healthier dietary habits and safe food.

The present report provides data on concentrations of numerous compounds in food groups, exposure estimations and time trend analyses. We believe that the report is of interest for risk assessors and risk managers working at agencies or institutions at national and regional levels but also at European level, such as European Food Safety Authority. Policy makers could also benefit the report in prioritization and decision making. The large data volumes are also believed to attract experts in the food sector and researchers at universities.

Numerous colleagues, both at the Swedish Food Agency and at other institutions, have made valuable contributions to this report. The following experts are specially acknowledged for reviewing the report: Per Ola Darnerud (PhD, toxicologist, Uppsala University), Karin Norström and Elisabeth Nyberg (both at the Swedish Environmental Protection Agency), Cecilia Axelsson, Hanna Eneroth, Emma Ankarberg (all at the Division of Risk and Benefit Assessment, Swedish Food Agency).

The per capita intakes are estimated using the Swedish Board of Agriculture’s food consumption statistics. Hence, these data are crucial for the estimations.

We would like to give special gratitude to the Swedish Environmental Protection Agency for their generous financial support of food collection, chemical analyses of potentially harmful compounds, and result reporting).

Livsmedelsverket

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1. Abbreviations

AI	Adequate intake. The AI is expected to meet or exceed the needs of most individuals in a life-stage group. The AI has larger uncertainty than RI and can be used when an RI cannot be determined.
AR	Average requirement. The average daily nutrient intake level that is estimated to meet the requirements of half of the individuals in a particular life-stage group in the general population. AR is usually used to assess adequacy of nutrient intake of population groups.
bw	Body weight
dl	Dioxin-like
EFSA	European Food Safety Authority
EU	European Union
E%	Energy percentage
FA	Fatty acid
FAO	Food and Agriculture Organization
LB	Lower bound. Non-detects are set to 0.
LMWDF	Low molecular weight dietary fibre
LOD	Limit of detection
LOQ	Limit of quantification
HB	Hybrid bound. Non-detects are set to 0.5*LOQ with exception for when all three samples in one food group have concentrations below LOQ. In those cases, non-detects are set to 0.
HBGV	Health-based guidance values
HC-ICP-MS	High Resolution Inductively Coupled Plasma Mass Spectrometry
HMWDF	High molecular weight dietary fibre
HPLC	High-performance liquid chromatography
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
MB	Medium bound. Non-detect are set to 0.5*LOQ.
MOE	Margin of exposure
MUFA	Monounsaturated fatty acid
NMR	Nuclear magnetic resonance spectroscopy
NNR	Nordic Nutrition Recommendations
NOAEL	No observed adverse effect level
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzfuran
PFAS	Per- and polyfluoroalkyl substances

Provisional AR	Provisional average requirement. The average daily nutrient intake level that is suggested to meet the requirements of half of the individuals in a particular life-stage group. Is used when an AR cannot be determined and has larger uncertainty than AR. Is calculated by multiplying adequate intake by a factor of 0.8.
PUFA	Polyunsaturated fatty acid
RI	Recommended intake. The average daily dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (usually 97.5%) individuals in a particular life-stage group in the general population.
RISE	Research institute of Sweden
RP	Reference point
SBA	Swedish Board of Agriculture
SFA	Saturated fatty acid
TDS	Total diet study
TFA	Trans fatty acid
TWI	Tolerable weekly intake
UB	Upper bound. Non-detects are set to LOQ.
UL	Upper level. The maximum level of total chronic daily intake of a nutrient (from all sources) which is not expected to pose a risk of adverse health effects to humans.
WHO	World Health Organization

2. Glossary

Food group	Group of food items that are homogenised into one sample in the market basket studies. 19 food groups are included in the Market Basket 2022 (e.g. cereal products, pastries, pizza/hand pie (subgroup), meat, processed meat (subgroup), lean fish, fatty fish, meat substitutes, lean dairy products, fatty dairy products, plant-based drinks, eggs, fats/oils, vegetables, fruits, potatoes, sugar/sweets, beverages, and coffee/tea).
Per capita consumption	The average food consumption in the population.
Per capita intake	The estimated average intake of a compound (both nutrients and potentially harmful substances).

3. Summary

The Swedish Food Agency regularly conducts so-called market basket studies. The purpose of the studies is to give an overall picture of how much nutrients and how much potentially harmful substances that the Swedish population is exposed to from the food.

The average amount of a substance that each person is exposed to from food is called per capita intake. In this report, we estimate per capita intake based on

- levels of nutrients or potentially harmful substances in different types of food
- how much of the different types of food each person consumes on average ("per capita consumption").

In the studies, we also compare per capita intakes with different types of reference values to detect possible health risks. Since the market basket studies are conducted regularly, we also investigate if there are trends over time.

3.1 Interim report of the Market Basket 2022

This interim report from the Market Basket 2022 includes

- fat, carbohydrates and protein
- vitamins
- essential minerals
- unwanted metals
- polychlorinated biphenyls (PCBs) and dioxins.

The results are compared with previous market basket studies from 1999, 2005, 2010 and 2015. Results for more substances[1] will be published in the final report.

The foods that were analysed[2] came from regular grocery stores in the autumn of 2022. We analysed samples from each food group and estimated per capita intake based on the levels of substances in the respective food group and per capita consumption of food within the food

[1] The final publication will also include results for mycotoxins, organochlorine pesticides, brominated and phosphorus flame retardants, plasticizers, poly- and perfluoroalkyl substances (PFAS), polycyclic aromatic hydrocarbons, chlorinated paraffins, glycidyl esters and MCPD esters, acrylamide and radionuclides.

[2] The following food groups were analysed: cereal products, pastries, meat, lean fish, fatty fish, meat substitutes, lean dairy products, fatty dairy products, plant-based drinks, eggs, fats and oils, vegetables, fruits, potatoes, sugars and sweets, beverages, coffee and tea.

group. To estimate per capita consumption, we mainly used statistics from the Swedish Board of Agriculture from 2020.

3.1.1 Results

The Market Basket 2022 shows that most vitamins, minerals and metals had a per capita intake that does not indicate a health risk in the population. However, the intake of saturated fat and salt was too high compared with the recommendations. Small margins to recommendations for vitamin D, folate, selenium, and iron indicate that there may be groups in the population who are at risk of deficiency of these nutrients. The intakes of cadmium and inorganic arsenic were close to the guideline for when there is a risk of adverse health effects. Although the intake of dioxins is high in relation to the guidance value, it decreases over time.

Fat, carbohydrates and protein

The distribution of energy intake from total fat, carbohydrates and protein was in consonance with the recommended values. For specific nutrients, the per capita intakes were as follows:

- Saturated fat was higher than the recommendations.
- Monounsaturated and polyunsaturated fat was in line with the recommendations.
- Trans fat remained low.
- Free sugar was too high.

Vitamins

For vitamins, per capita intakes were as follows:

- Vitamin A, E, K, thiamine and riboflavin were higher than the average requirements, indicating a sufficient intake of these nutrients in the Swedish population.
- Vitamin D was also higher than the average requirement, but with a smaller margin. This could imply that the intake is adequate in the general Swedish population but that there are groups at risk of deficiency.
- Folate was below average requirement, which could indicate a suboptimal intake in the general population. However, biomonitoring data from other studies show low prevalences of low plasma folate concentrations in Swedish adults.

Minerals

The per capita intakes of most minerals were well above the average requirement, suggesting that most people get enough. However, there are some exceptions:

- Selenium and iron had per capita intakes at or just above average requirements, indicating risk for deficiency of these minerals in some population groups.
- Sodium had too high per capita intake, which means an intake that increases the risk of chronic disease in the population.
- Phosphorus had so high per capita intake that it was just below levels that can have negative health effects.

Metals

The estimated intakes of all the investigated unwanted metals were below the health-based guidance values, which is the aim. Some were close however, mainly the intakes of cadmium and inorganic arsenic, where much of the exposure comes from cereals. Inorganic arsenic was considerably closer to the health-based guidance values in this market basket than in the previous market basket studies. This is mainly due to that the health-based guidance value for inorganic arsenic have been reduced, but also partly due to increased intake.

PCBs and dioxins

Fatty fish, fats/oils, fatty dairy products and meat contributed most to the total per capita intakes of PCBs[3] and dioxins[4]. The highest levels were found in fatty fish. The calculated per capita intakes of PCBs and dioxins decreased over time, which is positive. Nevertheless, for dioxins, it is at or above the tolerable weekly intake calculated by the European Food Safety Authority (EFSA).

[3] PCB measured as CB 153, a marker for non-dioxin like PCBs.

[4] Dioxins are measured as total-TEQ, corresponding to the sum of toxic equivalents of dioxin-like PCBs and PCDD/F.

4. Sammanfattning

Livsmedelsverket genomför regelbundet så kallade matkorgsundersökningar. Syftet med undersökningarna är att ge en övergripande bild över hur mycket näringsämnen och hur mycket ämnen som kan vara skadliga som den svenska befolkningen får i sig via maten.

Mängden av ett ämne som varje person får i sig i genomsnitt kallas per capita-intag. I denna rapport har vi uppskattat per capita-intaget utifrån

- hur mycket näringsämnen respektive ämnen som kan vara skadliga som finns i olika typer av livsmedel (halterna)
- hur mycket av de olika livsmedelsgrupperna som varje person konsumerar i genomsnitt ("per capita-konsumtion").

I undersökningen jämför vi också per capita-intagen med olika typer av referensvärden för att kunna upptäcka eventuella hälsorisker. Eftersom dessa matkorgsundersökningar sker regelbundet kan vi studera trender över tid.

4.1 Delrapport från Matkorgen 2022

I denna delrapport från Matkorgen 2022 ingår följande ämnen

- fett, kolhydrater och protein
- vitaminer
- livsnödvändiga mineraler
- oönskade metaller
- polyklorerade bifenyler (PCB) och dioxiner.

Resultaten jämförs med tidigare matkorgsundersökningar från 1999, 2005, 2010 och 2015. I slutrapporten kommer resultaten för fler ämnen[5] att bli publicerade.

De livsmedel som analyserades[6] kom från vanliga matbutiker under hösten 2022. Vi analyserade prover för varje livsmedelsgrupp och uppskattade sedan per capita-intaget utifrån

[5] De ämnen som tillkommer i slutrapporten är klororganiska bekämpningsmedel, bromerade flamskyddsmedel, per- och polyfluorerade alkylsubstanser (PFAS), klorparaffiner, fosforbaserade flamskyddsmedel, mjukgörare, polyaromatiska kolväten, glycidylestrar och MCPD-estrar, akrylamid, mykotoxiner och radionuklider.

[6] Följande livsmedelsgrupper ingår i analysen: spannmålsprodukter, bakverk, kött, mager fisk, fet fisk, vegetabiliska köttersättningsprodukter, magra mejeriprodukter, feta mejeriprodukter, växtbaserade drycker, ägg, fetter och oljor, grönsaker, frukter, potatis, socker och sötsaker, drycker samt kaffe och te.

halterna av ämnena i respektive livsmedelsgrupp och per capita-konsumtionen av mat inom livsmedelsgruppen. För att beräkna per capita-konsumtionen har vi främst använt data från Jordbruksverkets direktkonsumtionsstatistik från 2020.

4.1.1 Resultat

Matkorgen 2022 visar att de flesta vitaminer, mineraler och metaller hade ett per capita-intag som inte tyder på en hälsorisk i befolkningen. Intagen av mättat fett och salt var dock för högt jämfört med det rekommenderade intaget. Små marginaler till rekommendationer för D-vitamin, folat, selen och järn pekar på att det kan finnas grupper i befolkningen som har risk för brist av dessa. Intaget av kadmium och oorganisk arsenik låg nära riktvärdet för när det finns risk för negativ effekt på hälsan. Även intaget av dioxiner var högt i förhållande till riktvärdet, även om intaget minskar över tid.

Fett, kolhydrater och protein

Fördelningen mellan energiintagen från totala mängder fett, kolhydrater och protein låg inom de rekommenderade värdena. För respektive näringsämne såg per capita-intagen ut på följande sätt:

- Mättat fett var högre än rekommendationerna.
- Enkelomättat och fleromättat fett var i linje med rekommendationerna.
- Transfett var fortsatt lågt.
- Fritt socker var för högt.

Vitaminer

För vitaminer såg per capita-intagen ut på följande sätt:

- Vitamin A, E, K, tiamin och riboflavin var högre än det så kallade genomsnittsbehovet[7], vilket tyder på att den svenska befolkningen generellt får i sig tillräckligt av dessa vitaminer.
- Vitamin D var också högre än genomsnittsbehovet, men med mindre marginal, vilket tyder på att de flesta får i sig tillräckligt, men att det också finns grupper som riskerar brist.

[7] Genomsnittsbehovet, average requirement (AR), är det intag som är tillräckligt för att upprätthålla god näringsbalans, funktion och tillväxt för hälften av individerna i en viss grupp (utifrån kön, ålder, graviditet, amning). Genomsnittsbehovet används vid värdering av koster på befolkningsnivå.

- Folat var under genomsnittsbehovet, vilket tyder på att den svenska befolkningen generellt inte får i sig tillräckligt. Andra studier på folat visar dock att få vuxna i Sverige har låga nivåer i plasma.

Mineraler

Per capita-intaget av de flesta mineraler låg långt över genomsnittsbehovet, vilket tyder på att de flesta får i sig tillräckligt. Några resultat avviker dock från detta:

- Selen och järn hade per capita-intag i nivå med eller strax över genomsnittsbehoven, vilket innebär att det kan finnas en risk för brist på dessa mineraler i vissa befolkningsgrupper.
- Natrium hade för högt per capita-intag, vilket tyder på ett intag som ger ökad risk för kronisk sjukdom i befolkningen.
- Fosfor hade så högt per capita-intag att det ligger strax under nivåer som kan ha negativa hälsoeffekter.

Metaller

Per capita-intaget av alla de oönskade metallerna låg under de hälsobaserade riktvärdena, vilket är målet. För vissa metaller, framför allt kadmium och oorganisk arsenik, låg per capita-intaget dock nära riktvärdet. Största delen av det kadmium och oorganisk arsenik som finns i mat kommer från spannmål. För oorganisk arsenik var per capita-intaget mycket närmare riktvärdet i denna matkorgsundersökning än i tidigare matkorgsundersökningar. Det beror främst på att de hälsobaserade riktvärdena för oorganisk arsenik har sänkts, men också delvis på ökat intag.

PCB och dioxiner

Fet fisk, fetter/oljor, feta mejeriprodukter och kött bidrog mest till det totala per capita-intaget av PCB[8] och dioxiner[9]. De högsta halterna fanns i fet fisk. Det beräknade per capita-intaget av PCB och dioxiner minskar över tid, vilket är bra. För dioxiner ligger det ändå i nivå med eller över det tolerabla veckointaget som beräknats av Europeiska myndigheten för livsmedelssäkerhet, Efsa.

N.B. Rapporten är skriven på engelska. Endast titel och sammanfattning har översatts till svenska.

[8] PCB mäts som CB 153, som är en markör för icke dioxin-lika PCB:er.

[9] Dioxiner mäts som total-TEQ, som motsvarar summan av toxikologiska ekvivalenter av dioxin-lika PCB:er och PCDD/F.

5. Background

The Swedish Food Agency regularly conducts market basket studies to obtain current concentrations of a broad range of compounds in food groups representative for the Swedish food consumption. Foods are bought in major grocery stores, homogenised into pooled samples of specific food groups, and used as basis for chemical analyses of contaminants, naturally occurring unwanted substances, and nutrients. The contents in the market baskets are primarily based on statistics from the Swedish Board of Agriculture (SBA) (Swedish Board of Agriculture, 2021b), but also data from Swedish Food Agency´s dietary surveys (Riksmaten) (Amcoff et al., 2012, Warensjö Lemming et al., 2018a), household-consumption statistics and sales statistics. Hence, per capita consumption is estimated as a measure of mean consumption per person in the entire Swedish population. By combining the per capita consumption with concentrations of compounds in the food groups, the market basket studies give quantitative estimations of the average exposure of the compounds in the Swedish population (i.e. per capita intake estimations). This enables comparisons of per capita intakes of nutrients with nutrition recommendations, and, for potentially harmful substances, comparisons with health-based reference values. Because the market basket studies are conducted regularly, it is also possible to investigate time trends of per capita intake of those compounds. Previous market basket studies at the Swedish Food Agency are from 1999 (Darnerud et al., 2006, Becker et al., 2011), 2005 (Tornkvist et al., 2011, Becker et al., 2008), 2010 (Swedish Food Agency, 2012), and 2015 (Swedish Food Agency, 2017).

The market basket studies provide data on concentrations of compounds in food groups, exposure estimations and time trend analyses important for risk- and/or benefit assessments conducted at the Swedish Food Agency, but also at the European Food Safety Authority (EFSA). One advantage of market basket studies is that they provide analytical data and intake estimations for many compounds in a cost-effective way. Another advantage is that it is not based on self-reported data. The studies are limited by that the information is an average for the entire Swedish population and no individual data or distributions are given. By combining data from the market basket studies with food consumption data from dietary surveys (e.g. Riksmaten surveys) or biomonitoring data, an overall picture of time trends and exposure among certain population groups or high consumers can be assessed. The dietary surveys Riksmaten collect detailed consumption data on individual level by asking participants to register everything they eat or drink during specific reporting days (Amcoff et al., 2012, Warensjö Lemming et al., 2018a).

The market basket study resembles a so-called total diet study (TDS). However, the foods are analysed as *consumed* (i.e. cooked if appropriate) in a TDS, whereas the foods are analysed as *purchased* in the market basket study. Inedible parts such as peel, shell, bones, broth etc. are removed in market basket studies. Also, the market basket study uses average population consumption data and not individual food consumption data from dietary surveys, as recommended by the TDS guidelines (World Health Organization et al., 2011). Even if the market basket study not completely fulfils the criteria for a TDS, it has been conducted in agreement with the guidance of a harmonised total diet study approach produced by EFSA, Food and Agriculture Organization of the United Nations (FAO), and World Health Organization (WHO) (World Health Organization et al., 2011) as much as possible. TDS are performed in several countries, such as Germany (Sarvan et al., 2021, Stadion et al., 2022), France (ANSES, 2011), Portugal (Vasco et al., 2021), Italy (Cubadda et al., 2020), US (Gavelek et al., 2020), and Canada (Cao et al., 2019).

6. Aims

The main aims of the Market Basket 2022 are:

- To obtain data on concentrations of contaminants, naturally occurring unwanted substances and nutrients in food groups representative for the average Swedish food consumption.
- To estimate per capita intakes of analysed compounds in order to evaluate adherence to nutrition recommendations and possible risks of adverse health effects due to toxic compounds.
- To investigate contribution of major food groups to the total intake of analysed compounds.
- To evaluate time trends of intake for those compounds analysed in both the current and previous market basket studies.

7. Methods

7.1 Food groups and the per capita concept

7.1.1 Consumption data

Food consumption data in the market basket study was defined as per capita consumption, i.e. the total weight of food sold annually in Sweden divided by the number of inhabitants in Sweden. The consumption data for the majority of the food groups in the Market Basket 2022 were based on statistics from the SBA (Swedish Board of Agriculture, 2021b). Briefly, the statistics were based on the amount of food produced in Sweden, adjusted for export and import data, and minus a template of food waste in the industry. Household food waste was not considered in the statistics of the Swedish Board of Agriculture. Per capita consumption data in the Market Basket 2022 were based on preliminary data from 2020 (see Table 1). For some food groups, there were no data (meat substitutes and plant-based drinks) or only old data (fish) available from the SBA. The consumption of these food groups was therefore estimated using other data sources. Fish consumption was based on seafood statistics for 2019 derived from Research institute of Sweden (RISE) (Hornborg et al., 2021). Consumption of meat substitutes and plant-based drinks were estimated using house hold statistics from Growth from Knowledge 2021 (GfK, 2023).

Foods excluded from the market basket study were household salt, alcoholic beverages with ≥ 3.5 volume% alcohol, as well as food categories in the SBA´s statistics consumed less than 0.5 kg per person per year (Swedish Board of Agriculture, 2021b). These foodstuffs corresponded to 0.1% (household salt), 8% (alcoholic beverages ≥ 3.5 volume% alcohol), and 0.7% (food categories<0.5 kg/person/year) of the food weight according to the Swedish Board of Agriculture. Hence, the food groups included in the Market Basket 2022 contributed to more than 90% of the food consumption. Tap water was not included in the market basket study (except for the water included in coffee and tea).

7.1.2 Food groups

In the Market Basket 2022, the foods were divided into seventeen major food groups, in which compounds were analysed. In addition, two subgroups were included (pizza/hand pie and processed meat). The foodstuffs in these subgroups were also included in their major food groups pastries and meat, respectively. Table 1 describes the food groups included in the Market Basket 2022 as well as the per capita consumption per food group.

Table 1. Food groups in the Market Basket 2022 and the per capita consumption of these groups.

Food group[1]	Brief description of foods included in the food group	Per capita consumption (g/person/day)
Cereal products[2]	Fluor, grain, breakfast cereals, popcorn, pasta, bread	226
Pastries[2]	Biscuits, buns, cakes, pizza, hand pies	55
Subgroup: pizza, hand pie[2]	Pizza, hand pies	11
Meat[2]	Beef, pork, lamb, poultry, game, processed meats	194
Subgroup: processed meat[2]	Sausage, ham, meatballs, liver paste, bacon, ready-made meat dish	48
Lean fish[3]	Cod, Alaska pollock, canned tuna, shrimps, fish sticks	15
Fatty fish[3]	Salmon, smoked salmon, herring, mackerel, caviar	18
Meat substitutes[4]	Tofu, soy mince, vegetarian sausage/burgers, falafel	3
Lean dairy products[2]	Milk, sour milk, yoghurt	248
Fatty dairy products[2]	Cheese (hard, processed cottage), cream, sour cream	70
Plant-based drinks[4]	Oat, soy and almond drinks, plant-based yoghurt and cream	13
Eggs[2]	Fresh eggs	29
Fats and oils[2]	Butter, margarine, oil, mayonnaise, fatty dressings	55
Vegetables[2]	Fresh, frozen and canned vegetables, ketchup	245
Fruits[2]	Fresh, frozen, canned and dried, nuts, juice, jam	215
Potatoes[2]	Potatoes, French fries, crisps	142
Sugar and sweets[2]	Sugar, chocolate, candy, ice-cream, popsicle	74
Beverages[2]	Soft drinks (with sugar), diet soda, mineral water, beer (≤3.5 vol% alcohol)	262
Coffee and tea[2]	Filter coffee, instant coffee, brewed tea, tea bag	407
Total		2271

1 Coffee and tea were brewed and analysed as consumed since the powder is not consumed per se. All other products were analysed as purchased, but inedible parts were removed.
2 Data source: Swedish Board of Agriculture (Swedish Board of Agriculture, 2021b). Preliminary data for year 2020 were used. Therefore, there are some minor changes between data used in Market Basket study 2020 and the final statistics presented by Swedish Board of Agriculture.
3 Data source: RISE (Hornborg et al., 2021).
4 Data source: Growth from Knowledge (GfK, 2023). Household statistics from 2021 derived by consumer panels.

A food list was prepared and used as basis when the foods were purchased (see Appendix 1). The distribution of different foods within one food group (e.g. proportions of pasta, bread, rice etc. in the food group cereals) was based on data from the SBA. Food categories in the SBA´s statistics with a consumption of <0.5 kg/person/year were excluded from the food list (Swedish Board of Agriculture, 2021b). Distribution of different foods within each food category (e.g. amount hard bread, soft bread with or without the keyhole symbol) was mainly based on sales statistics from Nielsen IQ 2018 (Nielsen IQ), Growth for Knowledge consumer panel statistics from 2021 (GfK, 2023), and data from the national dietary surveys Riksmaten adults 2010-11 (Amcoff et al., 2012) and Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018a). Which specific brands that were included in the samples were mainly made based on sales statistics from Nielsen IQ 2018 (Nielsen IQ), and ranking of the most popular brands at the grocery stores´ online shops. If a specific brand on the food list could not be found, it was substituted with another brand according to the most popular brand at the grocery store´s online shop, and the food list was revised accordingly.

7.1.3 The per capita concept

In the present report, *per capita consumption* was used when describing average food consumption in the population. Per capita consumption was estimated by dividing the available total volume of a food category (mainly based on the SBA´s statistics) by the number of inhabitants in Sweden (10 353 000 (Swedish Board of Agriculture, 2021a)). The per capita consumption per food group is presented in Table 1.

Per capita intake was used to describe the estimated intake of a compound (both nutrients and potentially harmful substances). Per capita intake was derived by multiplying the per capita consumption for a specific food group with the concentration of the compound found in the food sample. This estimate was given on a per person basis. Figure 1 describes the formulas for calculating the estimated per capita intake of compounds.

Per capita intake from a specific food group:

(concentration of a compound in the food group) x (per capita consumption [g/person/day])

=

(Estimated daily intake of compound from specific food group per person)

Total per capita intake (per person basis):

$\sum(\text{Per capita intake per food group})_{\text{all food groups}}$

Total per capita intake (body weight basis):

$\sum(\text{Per capita intake per food group})_{\text{all food groups}}/70\ \text{kg}$

Figure 1. Formulas for estimating per capita intake in the Market Basket 2022.

For toxic or potentially harmful contaminants, the intake often needs to be given on body weight basis to be able to compare with health-based reference values. The formula for estimating intake per body weight is given in Figure 1. When converting data to body weight basis, 70 kg was used as a population mean body weight, as recommended by the EFSA (EFSA Scientific Committee, 2012). EFSA´s population mean body weight was considered relevant for the Swedish population because it was in agreement with population mean body weight also when considering population distribution in Sweden (68 kg). In this calculation, weight curves for children (Blomhoff et al., 2023) and weight data from the Public Health Agency of Sweden´s survey in 2022 (Public Health Agency of Sweden, 2023) for adults were used, see Appendix 2.

The approach for estimating the Swedish average consumer´s intake in the market basket study is an indirect method of monitoring intake, since foods purchased in stores were used as consumption data instead of information from consumers about their actual food consumption. This means that the consumption probably was overestimated as there are no adjustments for e.g. food waste in the retail sector or households (edible parts). Households account for most of the food waste in Sweden (70% of total). Household´s food waste in terms of inedible food parts were adjusted for in the market basket studies, but food waste as edible food parts and liquid food waste were not considered. These were estimated to 15 kg per person and year for edible foods (Hultén et al., 2024) and 18 kg per person and year for liquid foods (Hultén et al., 2024). This corresponded to about 4% of the per capita consumption in the Market Basket 2022. The most frequent foods in household food waste are coffee/tea, followed by dairy products and beverages (juice, soda, alcoholic beverages) (Åkerblom et al., 2021). However, all types of assessments of food consumption are suffering from errors or limitations of some kind, which may result in both under- and overestimations of the "real" consumption. Results from earlier Swedish market basket studies have shown good agreement with mean exposure estimates from population-based dietary surveys (e.g. dioxins (Darnerud et al., 2006), cadmium (Sand and Becker, 2012)).

7.2 Preparation of the samples

7.2.1 Foods list and collection of food

All foods were purchased in Uppsala, Sweden, between September and November 2022. Since year 2010, the collection of food has been conducted in one city only (Uppsala). In the market basket studies 1999 and 2005, foods were purchased from four cities (Malmö, Gothenburg, Uppsala, and Sundsvall). Because no significant or consistent regional differences were observed in these market basket studies, the regional collection was omitted in the latter three market basket studies. In line with the Market Basket 2015 (Swedish Food Agency, 2017), foods were not purchased over several seasons.

Samples were prepared for nineteen food groups (17 food groups and 2 subgroups), see Table 1. Within each sample, several foods from the food group were homogenised. The proportion of the foods in the sample was based on how much each food was consumed. Three samples were prepared for each food group, consisting of foods that were purchased from Sweden´s three major grocery chains (ICA, Axfood, and Coop). These grocery chains made up to about 90% of the market in year 2022 (ICA [50%], Axfood [21%], Coop [18%]) (DLF and Delfi, 2023). The three samples were made of similar foods but different brands were used. The market basket study is not designed to compare grocery chains, but to obtain a solid food sampling base to be used to estimate national per capita intake. Three different samples were prepared to include food from the major part of the market and to assess variability. In total, 57 samples were prepared (19 per grocery chain) and approximately 260 foodstuffs were purchased for the samples of each grocery chain. If a specific brand constituted more than 15% of a sample (based on the statistics described in section 7.1.2), several batches were included in the sample. Detailed information about number of samples per food group and substance are shown in Appendix 3.

7.2.2 Handling of food and samples

Upon arrival at the Swedish Food Agency, the foods were registered and given an individual record number, allowing the traceability of the foods contained in each sample. The foods were stored at the appropriate temperature (i.e., freezer, refrigerator, room temperature), respectively, until homogenisation and preparation of the samples.

It was important that the prepared samples were homogenous enough to be able to take a small subsample for analyses (sometimes less than 1 g) and that this subsample still was representative of the composition of the entire sample. Another important aspect when preparing the samples was that contamination of the samples must be avoided. However, since a broad spectra of compounds are analysed in the market basket studies, several parallel setups would be needed for all food groups if contamination should be completely avoided (e.g. no stainless steel knives for analyses of nickel or chromium, no plastic for analyses of flame retardants and dioxins). Several parallel sample preparations would however be too costly. Actions to avoid contamination were therefore taken as far as reasonably possible. The approach was generally to prepare the samples with carefully cleaned tools commonly used in a household kitchen. This process is described in more detail below.

The foods were homogenised as purchased, and no cooking was done (with exception of coffee/tea, see below). Only the edible part of the food was included in the samples. Vegetables, fruits and potatoes were peeled when appropriate. Half of the potatoes were peeled and half of the potatoes were homogenised with peel. Fishes were homogenised fileted and without skin, with exception of Baltic herring which was homogenised with skin.

Coffee and tea were brewed before analyses since the powder is not consumed as such. The exception was for the analysis of radionuclides, which was done on a mixture of raw powder of coffee and tea, and not brewed. The dosage and brewing were done according to the product instructions. Pots and other equipment used for brewing were washed with non-perfume detergent and rinsed with acetone. The two most popular brands for coffee filters per grocery chain were used. Tea was brewed using disposable tea bags. It is recommended to use tap water, preferably a pooled sample of several regions, but tap water from e.g. the laboratory is also sufficient (EFSA Scientific Committee, 2012). The laboratory at the Swedish Food Agency is located in a region with higher levels of per- and polyfluoroalkyl substances (PFAS) and fluoride in the drinking water. Also, it was decided that a national collection of tap water was not cost effective since drinking water is not the main aim of the market basket study. Therefore, a water installation with low levels of PFAS (sum of 11 PFAS <5 ng/L) and fluoride (0.1 mg/L) was identified and used for coffee and tea brewing. This water installation (Skråmsta renvatten) was located in the county of Örebro, Sweden. Water was collected in acid-washed plastic cans approved for food.

Equipment used in the homogenisation process was washed with non-perfume detergent and rinsed with acetone. A Retsch GM 300 with a stainless container was used for homogenisation. Some foods were freezed in -70°C before mixing to facilitate the homogenisation process (e.g., some cookies, dried fruits, chocolate, and candy). Depending on type of analyses, the homogenised samples were distributed to plastic containers, acid-washed plastic containers, Falcon tubes, brown glass containers (burned in oven at 300°C over night with tinfoil between container and top). The samples were stored in -70°C (samples for analyses of nutrients) or -20°C (samples for analyses of contaminants or naturally occurring unwanted substances) until analyses.

7.3 Chemical analyses

In general, three samples were analysed per food group and compound. However, all compounds were not analysed in all food groups. Which compounds to be analysed in which food groups were decided based on results from previous market basket studies (i.e. food groups that contained high vs low concentrations of a compound, time trends and margins of exposure estimations to health-based reference values) as well as costs. Appendix 3 shows in which food groups each compound was analysed and the number of samples per food group and compound. The methods for the chemical analyses of all compounds are described in Appendix 4.

7.4 Statistical analyses

Compound concentrations in food groups are described by mean, minimum, median, and maximum values. Because analyses were performed in three samples per food group, the minimum, median, and maximum values each correspond to the concentration of one sample. Because e.g. the maximum concentrations of several compounds could be obtained in different samples, data are presented as minimum, median, and maximum instead of sample 1, sample 2, and sample 3.

Values below quantification limit were for most compounds handled according to a hybrid bound (HB) approach. This means that concentrations below limit of quantification (LOQ) or limit of detection (LOD) was replaced by 0.5*LOQ or 0.5*LOD. However, if all three samples of a food group had concentrations below LOQ/LOD, these concentrations were set to 0. For mycotoxins available machine outputs were used for concentrations below LOQ. In addition, because of the use of toxicity equivalency factors, a medium bound approach was used for PCBs and dioxins (all concentrations <LOQ replaced by LOQ*0.5, see section 8.6.1).

Per capita intake was calculated as described in section 7.1.3. Per capita intake per kg bodyweight was calculated by assuming a population mean body weight of 70 kg (see section 7.1.3). Per capita intakes are described using lower bound (non-detects=0), hybrid or medium bound and upper bound (non-detects=LOQ or LOD) approaches. The hybrid or medium bound approach or machine outputs were used when estimating contribution of different food groups to the per capita intake and when investigating time trends of per capita intake. Compound specific deviations from this approach is described in the section of that specific compound, if any.

Changes over time were examined visually for all compounds analysed in at least one previous market basket study. Time trends of per capita intakes were investigated using linear regression analysis for compounds with a sufficient number of observations, generally with log (ln) transformed concentrations. P-values indicate a change in the per capita intake when we generalise the results to the Swedish population´s consumption of the foods available on the Swedish market. Even though many compounds were analysed in the market basket surveys, no multiple testing adjustments of p-values in time trend analyses were made. This was because the aim of the market basket studies is explorative. Intake from coffee/tea was not included in the time trend analyses. Intake from meat substitutes and plant-based drinks were included in the analyses. For compounds where fish consumption was suspected to drive the total per capita intake, time trend using fish consumption as defined by previous market basket studies was conducted as a sensitivity analysis. This means that the fish consumption was set to 37 g/person/day according to statistics of SBA (Swedish Board of Agriculture, 2021b) instead of 33 g/person/day to see if there were any major changes in the time trend.

8. Results

8.1 Time trends of the per capita consumption

One aim of the market basket studies is to investigate time trends in the estimated exposure of compounds analysed in a recurrent manner. The per capita intake is a function of per capita consumption and compound concentrations in the food groups. Hence, a time trend in per capita intake of a compound could be caused by a change in the consumption, a change in the concentrations or both. Both these aspects must therefore be considered when interpreting time trends in the per capita intake. Time trends in per capita intake of the compounds are presented in the results section for each analysed compound, when applicable. Time trends in per capita consumption of food groups are presented below (Figure 2 and Table 2).

It is important to consider several aspects that contribute to uncertainties when interpreting time trends in the per capita consumption. Firstly, age distribution in the Swedish population has changed over time. Energy requirement and food consumption in the population may change due to this distribution. Secondly, changes in population behaviour regarding food waste could also have an impact on the per capita consumption, even if the actual food consumed is not changed. If a reduction of food waste in households leads to that less foods are bought, this means that the per capita consumption is reduced despite that people are eating the same amount. If, on the other hand, a reduced food waste is concomitant with increased consumption, such increased consumption will not be detected in the per capita consumption. Thirdly, home production of food is not included in the per capita consumption. Therefore, changes in consumption due to home produced food are not captured by market basket studies. Fourthly, the methodology of the market basket studies has been slightly modified over time. For example, changes in aggregation of foods into food groups have differed slightly between the studies, and food purchase has been conducted in different seasons. Also, in the Market Basket 2022, another data source of fish consumption was used and three new food groups were included (meat substitutes, plant-based drinks, and coffee/tea).

Table 3 shows the major changes in the Market Basket 2022 compared with previous market basket studies. The consumption of coffee and tea was not included in the time trends. The reason is that this food group has not been included in previous market basket studies. Therefore, the time trends of per capita consumption, and possibly also intake, would increase if the consumption of coffee and tea was included. Coffee and tea consumption was however included when estimating the exposure assessment in the results, if applicable (i.e., when not investigating time trends).

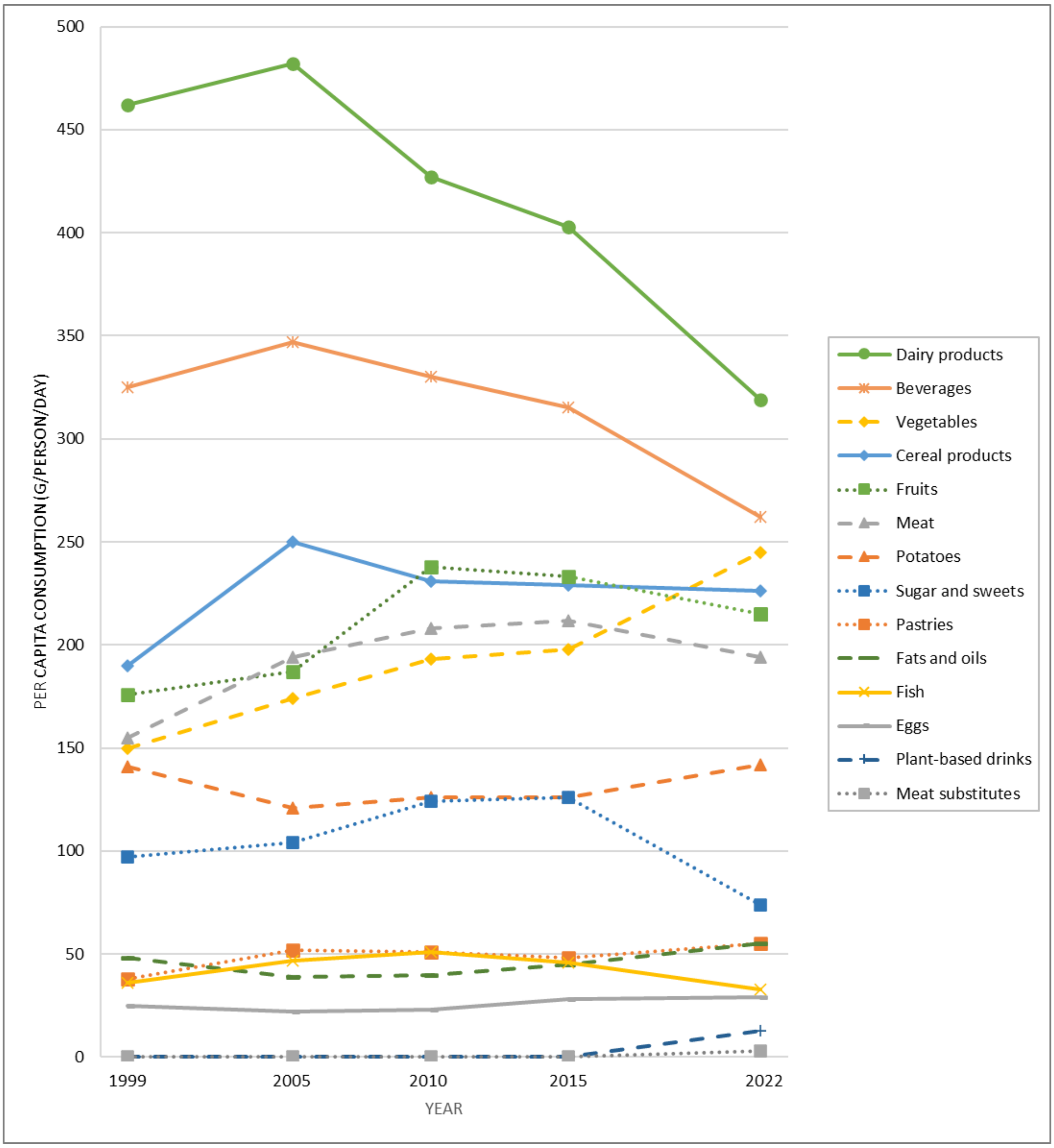

Figure 2. Changes over time of the Swedish per capita consumption (g/person/day) in the five market basket studies conducted between 1999 and 2022.

The food groups meat substitutes and plant-based drinks were not included in the market basket studies before 2022. The consumption of these were therefore set to zero between 1999 and 2015. Coffee/tea are not shown in the figure as this food group was not included in market basket studies before year 2022. Observe that some foodstuffs have been categorized differently in the Market Basket 2022 compared with previous studies (see Table 2 and Table 3).

Table 2. The Swedish per capita consumption (g/person/day) in the market basket studies conducted between 1999 and 2022.

Food group	Per capita consumption (g/person/day)				
	1999	2005	2010	2015	2022
Cereal products	190	250	231	229	226
Pastries	38	52	51	48	55
Meat	155	194	208	212	194
Fish	36	47	51	46	33[1]
Meat substitutes	-	-	-	-	3[2]
Dairy products	462	482	427	403	318[3]
Plant-based drinks	-	-	-	-	13[2]
Eggs	25	22	23	28	29
Fats and oils	48	39	40	45	55[4]
Vegetables	150	174	193	198	245[5]
Fruits	176	187	238	233	215
Potatoes	141	121	126	126	142
Sugar and sweets	97	104	124	126	74[6]
Beverages	325	347	330	315	262
Coffee and tea	-	-	-	-	407[7]
Total	1 844	2 020	2 041	2 008	1864

[1] Sum of lean fish and fatty fish consumption (15 g and 18 g, respectively). Another data source was used in the Market Basket 2022 compared to previous market basket studies. The fish consumption calculated in line with previous studies (based on statistics from the Swedish Board of Agriculture) was 37 g/person/day.
[2] Meat substitutes and plant-based drinks were not included in market basket studies before year 2022.
[3] Sum of lean and fatty dairy products (248 g and 70 g, respectively).
[4] The increase was partly explained by that the consumption of fatty dressings (7 g/person/day) was included in the food group fats/oils in the Market Basket 2022 instead of sugar/sweets as in previous studies.
[5] The increase was partly explained by that the consumption of ketchup (20 g/person/day) was included in the food group vegetables in the Market Basket 2022 instead of sugar/sweets, as in previous studies.
[6] The decrease was partly explained by that the consumptions of fatty dressings (7 g/person/day) and ketchup (20 g/person/day) were included in the food group fats/oils and vegetables, respectively, in the Market Basket 2022.
[7] Coffee/tea were not included in market basket studies before year 2022. This group was not included in the time trends of per capita consumption (and in the total consumption above).

Briefly, per capita consumptions of dairy products, beverages and sugar/sweets decreased in the Market Basket 2022 compared with previous market basket studies, whereas fats/oils and vegetables increased. The decreasing time trend of dairy products was mainly explained by a lower consumption of milk products (milk, sour milk and yoghurt), which was about 80% of the consumed dairy products in the Market Basket 2022. A decreasing time trend of milk products has also been observed among 70-year-old Swedes (Samuelsson et al., 2019). The increases in consumption of fats/oils and vegetables, and the decrease in consumption of sugar/sweets are probably mainly explained by the redistribution of fatty dressings and ketchup from the food group sugar/sweets to fats/oils, and vegetables, respectively. However, increased intake of vegetables has been indicated among 70-year-olds (Samuelsson et al., 2019), whereas another Swedish study observed a rather stable consumption (Törmä et al., 2021). The decrease in the food group sugar/sweets did not seem to be fully explained by the redistribution of fatty dressings and ketchup but also by an actual reduction in consumption of sugar/sweets. A decreased intake of sweets has also been indicated among adults in Northern Sweden (Törmä et al., 2021). The decreasing time trend for beverages was mainly explained by a lower consumption of beer (≤3.5 vol% alcohol). In contrast, intake of soda has rather increased since 2015 (Swedish Board of Agriculture, 2021b, Sveriges bryggerier, 2020). The distribution of sugar-free soda has increased with simultaneous decrease in sugar-sweetened soda (Sveriges bryggerier, 2020). A small decrease in fish consumption was observed in the Market Basket 2022. This could partly, but probably not entirely, be explained by use of another data source. A decrease is also indicated by a stable production of sea food over time with a simultaneous larger population (Hornborg et al., 2021). However, time trends of fish consumption are uncertain and there are also data suggesting a stable trend (Törmä et al., 2021). One must also keep in mind that the pandemic of covid-19 started in year 2020, which could temporarily have influenced the consumption of specific food groups and hence having an impact on the results.

As mentioned above, fish consumption statistic by RISE was used instead of statistic from the SBA. The reason was that the SBA does not produce any data on fresh fish and shellfish after year 2000 due to uncertainty in the data source. Briefly, fish consumption was calculated in a similar way, but the per capita consumption was lower according to RISE (12 kg/person/year (Hornborg et al., 2021)) compared with the SBA (15 kg/person/year). The differences between RISE and the SBA could be due to that different conversation factors from whole fish to editable parts were used, that more whole fish were included in the statistics of the SBA, and/or a negative trend in fish consumption since 1999. Due to the change of fish consumption statistics and inclusion of three new food groups, special consideration for these issues were taken when investigating time trends in the intakes of substances (see section 7.4).

Table 3. Major changes of the food groups and compilation of the food list in the Market Basket 2022 compared with previous market basket studies.

Food group	Change and implication on time trend
Cereals	Corn cereals and popcorn were included in the Market Basket 2022 but not in previous market basket studies. These products were included because of their relatively high consumption. These consumption data were included as other cereals in previous market basket studies, and the change did therefore not affect the time trend of total cereal consumption.
Pastries	The proportion of pizza/hand pie was decreased compared with previous market basket studies as a consequence of updated consumption data (26% and 40% in Market Basket 2022 and Market basket 2015, respectively). This may have affected the time trends of compounds such as sodium, fat, and sugars.
Fish	Updated consumption data from RISE were used instead of older data from Swedish Board of Agriculture, which slightly decrease the estimated consumption (33 g/person/day instead of 37 g/person/day). This may have affected the time trends for compounds with high concentrations in the fish groups. Fish and shellfish were divided into two groups: lean and fatty fish. Previous market basket studies did only have one fish group.
Meat substitutes	New food group not included in previous market basket studies.
Dairy products	Dairy products were divided into two groups: lean and fatty. This categorisation was used for some compounds in the Market basket 2015.
Plant-based drinks	New food group not included in previous market basket studies.
Fats and oils	Fatty dressings (béarnaise sauce) were included in the food group fats/oils in the Market Basket 2022 instead of sugar/sweets, as in previous market basket studies. This affected the time trends of both fats/oils (increased with 7 g/person/day) and sugar/sweets (decreased with 7 g/person/day).
Vegetables	Ketchup was included in the food group vegetables in the Market Basket 2022 instead of sugar/sweets, as in previous market basket studies. This affected the time trends of both vegetables (increased with 20 g/person/day) and sugar/sweets (decreased with 20 g/person/day).
Sugar and sweets	Ketchup and fatty dressings were included in vegetables and fats/oils, respectively in the Market Basket 2022. This decreased the consumption of sugar/sweets with 27 g/person/day.

Food group	Change and implication on time trend
Coffee and tea	New food group not included in previous market basket studies.
Other	Ready to eat soups and broths were excluded from the food groups meat, fish, and vegetables as the contents of meat, fish and vegetables were very little and hence diluted these food groups. Because of the low consumption of soups and broths (1.6-3.3 g/person/day per food group), the impact on the time trends were considered limited.
Number of samples	Samples from three different grocery chains were included in the Market Basket 2022 compared with five in previous studies. Instead, number of food groups were increased in the Market Basket 2022.

8.2 Macronutrients

Macronutrients are energy-giving nutrients required in larger quantities. They provide us with energy needed by all cells in the body. The main contributors to energy in foods are carbohydrates (17 kJ/g [4 kcal/g]), proteins (17 kJ/g [4 kcal/g]), fats (37 kJ/g [9 kcal/g]), and dietary fibres (8 kJ/g [2 kcal/g]). Alcohol also provides energy (29 kJ/g [7 kcal/g]), but is not included in the recommended intake of energy in the Nordic Nutrition Recommendations (NNR) (Blomhoff et al., 2023). Protein, fat, carbohydrate and dietary fibre were assessed in the Market Basket 2022. Also, individual fatty acids and different kinds of carbohydrates (starch and sugars) were measured.

Total fat, mono- and disaccharides, water, ash and protein (as nitrogen) were analysed by Eurofins Food & Feed Testing Sweden in Linköping. Starch was analysed by Eurofins Food & Feed Testing Norway. Resistant starch was not included in the starch analysis, but free glucose was included in the analysis for the food groups meat, processed meat, lean and fatty fish, lean and fatty dairy products, egg, and fats/oils. High molecular weight dietary fibres (HMWDF) (including resistant starch) and low molecular weight dietary fibres (LMWDF) were analysed by Eurofins Food & Feed Testing Netherlands. Fatty acids were analysed using gas chromatography by the Swedish Food Agency. All laboratories were accredited. Methods, measurement uncertainties, and LOQs are shown in Table 4. The chemical analyses are described in more detail in Appendix 4 (section A4.1).

Protein was calculated using the standard nitrogen conversion factor of 6.25 (Regulation (EU) No 1169/2011). Using specific nitrogen conversion factors for individual food groups did only have minor impact on the per capita intake of protein (less than 2 g/day in difference). For simplicity, the factor of 6.25 was therefore used in this report. Total carbohydrate was calculated by difference, i.e. 1000 g - water (g/kg) - ash (g/kg) - fat (g/kg) - protein (g/kg) - total fibre (g/kg). Alcohol was not analysed in the Market Basket 2022 and not included in the calculation. Total fibre content was calculated as the sum of HMWDF (including resistant starch) and LMWDF. Energy content was calculated by the formulas (17*protein (g/kg) + 37*fat (g/kg) + 17*carbohydrates (g/kg) + 8*fibres (g/kg)), and (4*protein (g/kg) + 9*fat (g/kg) + 4*carbohydrates (g/kg) + 2*total fibres (g/kg)) for kJ and kcal, respectively (Regulation (EU) No 1169/2011). Total fibre content was assumed to be zero for the food groups lean and fatty dairy products, fats/oils, eggs, and beverages in the calculations of total carbohydrates and energy contents. Fat and protein contents in the food group beverages were also assumed to be zero in the calculation of energy content. The formulas for calculating the groups of fatty acids are shown in Appendix 4 (section A4.1).

Table 4. Limit of quantification (LOQ) and measurement uncertainty for analyses of macronutrients in the Market Basket 2022.

Substance	LOQ	Measurement uncertainty
Fat, total[1]	1 g/kg	±10%
Fatty acids (FA)	0.1%	±34% if FA ≤0.5% ±7% if FA >0.5-6% ±5% if FA >6% ±10% total trans FAs
Nitrogen (Kjeldahl)[2]	0.5 g/kg	±10%
Fibre, total		
High molecular weight fibres + resistant starch	4 g/kg	±18.5%
Low molecular weight fibres	2 g/kg	±15.4-22.0%
Starch	10 g/kg	15%
Glucose	0.4 g/kg	±15-25%
Fructose	0.4 g/kg	±15-25%
Sucrose	0.4 g/kg	±15-30%
Lactose	0.4 g/kg	±15-25%
Maltose	0.4 g/kg	±15-25%
Galactose	0.4 g/kg	±25%
Ash	1 g/kg	±10%
Water[3]	1 g/kg	±10%

1 g/kg = 0.1 g/100 g.

[1] Lean dairy products: LOQ = 0.02 g/kg, measurement uncertainty = ±8%.

[2] Fats and oils: LOQ = 0.5 g/kg, measurement uncertainty = ±20%.

[3] Fats and oils: LOQ = 1 g/kg, measurement uncertainty = ±25%. Lean and fatty dairy products: LOQ = 1 g/kg, measurement uncertainty = ±10%.

8.2.1 Concentrations in food groups

Concentrations of macronutrients, nitrogen, water, and ash in the different food groups in the Market Basket 2022 are presented in Table 5 together with energy content estimations. The concentrations of fatty acids and different carbohydrates are shown in Table 6 and Table 7, respectively. Nutrient claims are regulated according to the EU regulation for nutrient claims (Regulation (EC) No 1924/2006). The purpose of the regulation is to harmonise the provisions for nutrition and health claims for commercial communication of individual products. An evaluation of the nutrient content of the food groups in the Market Basket 2022 was done using the EU regulation 1924/2006 (Regulation (EC) No 1924/2006). It should however only be considered as an indication, and individual food items can still fulfil the requirements for a nutrient claim although the food group has a content below the requirement.

Energy

The highest energy content was obtained in fats/oils followed by sugar/sweets and pastries (Table 5). Vegetables was the only food group with enough energy content to fulfil the criterion for the claim low in energy (i.e. 170 kJ/100 g for solids and 80 kJ/100 mL for liquids (Regulation (EC) No 1924/2006)).

Protein

Fatty dairy products, meat, and fatty fish had the highest protein concentrations if not considering energy content (Table 5). A claim that a food is high in protein may be made where at least 20% of the energy value of the food is provided by protein (Regulation (EC) No 1924/2006). This criterion was fulfilled for lean fish (73% of energy from protein), meat (40%), eggs (36%), meat substitutes (34%), fatty fish (33%), lean dairy products (27%), fatty dairy products (23%), and processed meat (21%). Vegetables (16% of energy from protein) and cereal products (14%) fulfilled the criterion for a food to be claimed as a source of protein, i.e. at least 12% of the energy from protein (Regulation (EC) No 1924/2006).

Fat and fatty acids

The highest total fat concentration was measured in fats/oils, followed by fatty dairy products and processed meat (Table 5). Lean fish, vegetables, fruits and potatoes had a fat content of no more than 3 g per 100 g, which is the criterion to claim that a food is low in fat (Regulation (EC) No 1924/2006). Because of the high total fat content in fats/oils, this food group contained the highest concentrations of all determined subgroups of fat except for trans fatty acids (TFA), (i.e. saturated fatty acids [SFA], monounsaturated fatty acids [MUFA], polyunsaturated fatty acids [PUFA], n-3 PUFA and n-6 PUFA), see Table 6. The highest concentrations of MUFA found in fats/oils were followed by processed meat, pastries, fatty fish and fatty dairy products. The highest concentrations of PUFA in fats/oils were followed by fatty fish for total PUFA and n-3 PUFA, and by meat substitutes and pastries for n-6 PUFA. The second highest concentrations of SFA (in addition to fats/oils) and the highest concentrations of TFA were detected in fatty dairy products. The food groups cereals, fruits and potatoes had a content of no more than 1.5 g per 100 g and less than 10% of energy from the sum of SFA and TFA, which is the criterion to claim that a food is low in saturated fat (Regulation (EC) No 1924/2006). Individual fatty acids were not analysed in the food groups vegetables, beverages and coffee/tea due to their low fat content. Proportion of individual fatty acids of total fatty acids are presented in Appendix 5 (section A5.1).

Carbohydrates and dietary fibres

Sugar/sweets, cereal products and pastries had the highest contents of total carbohydrates (Table 5). Starch (excluding resistant starch) was most prevalent in cereal products and pastries, whereas the highest concentrations of dietary fibres (including resistant starch) were detected in potatoes, cereal products and meat substitutes (Table 7). High concentrations of both HMWDF (including resistant starch) and LMWDF were seen in cereal products, but the highest concentration of HMWDF were detected in potatoes (Table 7). Cereal products, potatoes and vegetables fulfilled the criterion to claim that a food is high in fibre (i.e. at least 6 g per 100 g or 3 g per 100 kcal (Regulation (EC) No 1924/2006)). Fibre contents in pastries, meat substitutes, and fruits were in accordance with the criterion for foods to be claimed as a source of fibre (i.e. at least 3 g per 100 g or 1.5 g per 100 kcal (Regulation (EC) No 1924/2006)).

Whole grain is defined as the whole kernel of the cereal (the bran, the germ, and the endosperm). There are no chemical analyses to detect the whole grain content of a food item. The content of whole grains was therefore estimated based on product information. The calculations were conducted for the food groups cereal products and pastries. The food group cereal products were estimated to contain approximately 17 g whole grains per 100 g. The food group pastries were estimated to contain approximately 2.7 g whole grains per 100 g.

The highest sugar concentration was found in sugar/sweets, followed by pastries and fruits (Table 7). A food can be claimed to be low in sugars if it contains no more than 5 g per 100 g for solids or 2.5 g per 100 mL for liquids (Regulation (EC) No 1924/2006)). This criterion was obtained for the food groups meat, processed meat, fatty and lean fish, meat substitutes, fatty dairy products, eggs, fats/oils, and potatoes. The content of individual mono- and disaccharides are shown in Table 7. Added sugars are refined sugars used as such or added during food preparation and manufacturing. Free sugars include added sugars but also sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates. Since there is a recommendation on the intake of added and free sugars (Blomhoff et al., 2023), it was deemed relevant to also estimate the content of free sugars in the Market Basket 2022. The definition of free sugars, and not added sugars, was used when estimating the content in the Market Basket 2022 because free sugars are more inclusive (Sonestedt and Overby, 2023). The estimations were conducted according to the procedure used in the Swedish Food Composition Database (Wanselius et al., 2019, Swedish Food Agency, 2023), and were based on chemically analysed concentration data, product information and data from the Swedish Food Composition Database. The highest estimated contents of free sugars were obtained in sugar/sweets (52 g/100 g) and pastries (18 g/100 g), followed by the food groups beverages, fatty fish, fruits (approximately 4 g/100 g each), cereal products (3 g/100 g), and vegetables (2 g/100 g). The other food groups had less than 2% estimated free sugar content. The sources of free sugar in fatty fish were mainly pickled herring, but also mackerel in tomato sauce and caviar to some extent.

Table 5. Concentrations of macronutrients, nitrogen, ash and water per kg in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	*Pizza, hand pie*	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea
Energy[1] (MJ/kg)	Mean	13	16	NA	7.6	10	3.8	9.2	7.9	2.2	13	2.4	5.9	25	1.5	4.0	3.6	17	0.85	NA
	Min	13	16		7.3	10	3.8	8.7	7.4	2.1	13	2.3	5.9	25	1.5	3.9	3.5	16	0.77	
	Median	13	16		7.6	10	3.8	9.0	7.9	2.2	13	2.5	5.9	25	1.5	4.0	3.6	17	0.82	
	Max	14	17		7.7	11	4.0	9.8	8.4	2.2	13	2.6	6.0	26	1.6	4.2	3.8	17	0.97	
Energy[1] (kcal/kg)	Mean	3146	3868	NA	1813	2491	912	2197	1894	519	3183	583	1426	6197	363	963	873	3955	200	NA
	Min	3100	3803		1763	2412	891	2078	1780	507	3138	541	1416	6117	352	932	837	3891	180	
	Median	3129	3807		1818	2528	904	2154	1887	523	3161	587	1427	6185	361	956	864	3954	192	
	Max	3210	3993		1857	2535	940	2358	2014	528	3249	619	1433	6289	377	1001	920	4021	228	
Fat (g/kg)	Mean	36	158	NA	117	197	23	143	104	19	252	25	99	673	3.9	27	19	104	0*	NA
	Min	31	147		115	192	20	132	90	18	246	17	99	662	3.6	25	17	98		
	Median	37	160		117	200	22	133	107	19	249	27	99	669	3.8	26	20	104		
	Max	40	167		118	200	26	164	116	20	261	32	99	687	4.2	30	20	110		
Nitrogen (g/kg)	Mean	17	11	NA	28	20	26	28	25	5.5	29	2.4	20	0.80	2.3	2.8	3.3	6.2	0*	NA
	Min	17	11		26	20	26	26	25	5.4	28	2.0	20	0.80	2.2	2.3	3.0	5.7		
	Median	17	12		29	20	26	29	25	5.5	28	2.3	20	0.80	2.4	2.4	3.3	6.3		
	Max	18	12		30	21	27	30	25	5.7	29	2.8	20	0.80	2.4	3.6	3.7	6.7		
Protein[2] (g/kg)	Mean	108	72	NA	176	125	165	176	156	35	179	15	125	5.0	15	17	21	39	0*	NA
	Min	105	71		161	122	163	163	155	34	176	13	124	5.0	14	14	19	36		
	Median	107	72		181	124	164	182	156	34	177	14	124	5.0	15	15	21	39		
	Max	113	72		187	129	168	184	157	36	183	18	127	5.0	15	23	23	42		
Carbohydrates[3] (g/kg)	Mean	566	523	NA	12	54	11	46	56	52	50	71	8.6	31	55	150	105	707	50	NA
	Min	546	503		0	47	3.5	36	47	51	47	67	7.8	22	53	147	99	694	45	
	Median	560	531		18	54	4.0	49	60	52	49	68	7.8	35	55	149	102	707	48	
	Max	590	536		18	60	24	52	61	53	54	77	10	36	58	153	114	720	57	
Fibres[4] (g/kg)	Mean	64	33	NA	4.3	0	3.0	10	53	0*	0*	6.7	0*	0*	24	26	100	18	0*	NA
	Min	62	30		<6	<6	<6	7	52			5			22	25	88	17		

		Cereal products	Pastries	*Pizza, hand pie*	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea
	Median	62	33		2	<6	<6	11	54			7			25	26	105	18		
	Max	68	36		5	<6	5	11	54			8			26	27	106	18		
Ash (g/kg)	Mean	13	14	NA	17	28	15	21	22	7.3	26	6.9	8.7	12	7.5	5.2	10	9.0	0	1.5
	Min	13	13		16	26	13	20	22	7.1	24	5.3	8.6	11	7.1	5.2	8.9	8.2	<1	1.3
	Median	13	14		17	28	15	22	22	7.4	27	7.5	8.7	11	7.4	5.2	11	8.2	<1	1.4
	Max	14	14		18	31	16	22	22	7.4	28	7.9	8.9	12	7.9	5.3	12	11	<1	1.7
Water (g/kg)	Mean	213	200	480	678	595	784	603	608	887	493	876	759	280	894	775	745	123	950	990
	Min	191	182	480	665	590	773	588	593	886	487	874	757	274	891	769	731	115	943	989
	Median	220	200	480	682	590	789	600	613	886	489	875	758	279	894	776	741	115	952	990
	Max	228	219	481	686	606	791	621	619	889	503	878	761	287	898	779	763	140	955	990

1 g/kg = 0.1 g/100 g.

NA, not analysed; 0*, content was assumed to be logical zero and no analyses were performed.

< indicates a value below limit of quantification (LOQ). When calculating means as well as energy, carbohydrate and total fibre contents, hybrid bound approach was used. This means that medium bound concentration (0.5*LOQ) was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculation mean.

[1] Calculated by the formulas (17*protein (g/kg) + 37*fat (g/kg) + 17*carbohydrates (g/kg) + 8*fibres (g/kg)), and (4*protein (g/kg) + 9*fat (g/kg) + 4*carbohydrates (g/kg) + 2*total fibres (g/kg)) for kJ and kcal, respectively (Regulation (EU) No 1169/2011).

[2] Protein content was calculated using the standard nitrogen conversion factor of 6.25 (Regulation (EU) No 1169/2011).

[3] Carbohydrates were calculated by difference, i.e. 1000 g - water (g/kg) - ash (g/kg) - fat (g/kg) - protein (g/kg) - total fibre (g/kg). Negative contents were replaced by zero (i.e. concentrations of one meat sample and upper bound concentration of one fish sample).

[4] Total fibre content was calculated as the sum of resistant starch, high molecular weight dietary fibres (HMWDF) and low molecular weight dietary fibres (LMWDF). < are the sum of both LOQ (HMWDF: <4 g/kg, LMWDF: <2 g/kg). If one fibre type had concentration <LOQ, the quantified concentration of the other type was shown.

Table 6. Concentrations of fatty acids per kg in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets
FA factor[1]		0.73	0.96	0.95	0.95	0.70	0.90	0.80	0.94	0.94	0.94	0.83	0.96	NA	0.93	0.96	0.96
Fat, total	Mean	36	158	117	197	23	143	104	19	252	25	99	673	3.9	27	19	104
(g/kg)	Min	31	147	115	192	20	132	90	18	246	17	99	662	3.6	25	17	98
	Median	37	160	117	200	22	133	107	19	249	27	99	669	3.8	26	20	104
	Max	40	167	118	200	26	164	116	20	261	32	99	687	4.2	30	20	110
SFA	Mean	3.4	59	47	75	2.0	22	21	13	166	2.4	25	193	NA	3.6	3.4	53
(g/kg)	Min	3.1	54	46	74	1.9	20	14	12	160	1.6	25	188		2.9	1.5	50
	Median	3.3	60	47	75	2.0	20	23	13	164	2.8	25	190		3.8	2.1	52
	Max	3.9	62	47	76	2.2	25	27	13	173	2.9	26	200		4.2	6.5	56
MUFA	Mean	12	69	53	93	8.4	67	37	4.5	62	13	40	316	NA	16	10	39
(g/kg)	Min	10	66	53	90	7.6	59	29	4.2	61	8.6	38	314		14	8.1	36
	Median	12	67	54	93	8.0	64	40	4.4	62	14	41	316		15	11	39
	Max	15	75	54	94	9.5	79	42	4.8	63	17	41	319		18	12	42
PUFA	Mean	10	24	9.9	19	5.4	40	25	0.58	7.7	7.8	17	133	NA	5.6	4.3	7.8
(g/kg)	Min	9.0	21	9.2	17	4.7	36	22	0.53	7.3	5.3	16	128		5.5	2.5	6.9
	Median	11	24	10	19	5.4	39	24	0.60	7.7	8.5	17	131		5.7	4.4	8.0
	Max	11	25	11	20	6.2	44	30	0.61	7.9	9.5	18	139		5.7	6.1	8.5
n-3 PUFA	Mean	1.4	4.3	0.87	1.4	2.9	23	4.5	0.10	1.0	1.6	2.0	36	NA	0.58	0.21	0.29
(g/kg)	Min	1.1	3.7	0.77	1.2	2.6	20	2.8	0.09	0.98	1.1	1.8	34		0.55	0.19	0.25
	Median	1.5	4.4	0.91	1.4	3.1	22	5.2	0.11	1.0	1.7	1.9	35		0.59	0.19	0.28
	Max	1.7	4.8	0.93	1.6	3.1	26	5.5	0.11	1.1	2.0	2.1	39		0.61	0.27	0.33
18:3 n-3	Mean	1.4	4.3	0.87	1.2	0.85	5.7	4.5	0.10	1.0	1.6	0.92	36	NA	0.58	0.21	0.29
(g/kg)	Min	1.1	3.7	0.77	1.1	0.68	5.4	2.8	0.09	0.98	1.1	0.85	34		0.55	0.19	0.25

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets
	Median	1.5	4.4	0.91	1.2	0.78	5.4	5.2	0.11	1.0	1.7	0.92	35		0.59	0.19	0.28
	Max	1.7	4.8	0.93	1.4	1.1	6.5	5.5	0.11	1.1	2.0	1.0	39		0.61	0.27	0.33
n-6 PUFA (g/kg)	Mean	9.0	18	8.2	16	2.4	16	21	0.28	4.2	6.2	15	88	NA	5.0	4.1	6.7
	Min	8.0	17	7.5	15	2.1	14	17	0.25	4.1	4.2	14	85		4.9	2.2	6.0
	Median	9.2	19	8.2	17	2.3	16	18	0.28	4.2	6.8	15	87		5.1	4.2	6.7
	Max	9.8	19	8.8	17	3.0	17	27	0.29	4.3	7.4	16	91		5.1	5.9	7.3
TFA (g/kg)	Mean	0.00	0.48	1.6	0.79	0.05	0.88	0.27	0.73	10	0.00	0.11	6.7	NA	0.00	0.03	0.51
	Min	0.00	0.40	1.5	0.71	0.04	0.75	0.25	0.68	10	0.00	0.10	5.8		0.00	0.01	0.45
	Median	0.00	0.46	1.5	0.77	0.05	0.85	0.26	0.72	10	0.00	0.11	6.5		0.00	0.04	0.50
	Max	0.00	0.57	1.7	0.91	0.06	1.0	0.30	0.78	10	0.00	0.12	7.7		0.00	0.05	0.57

1 g/kg = 0.1 g/100 g. Hybrid bound approach are used for values below limit of quantification. Concentrations estimated by lower bound and upper bound approaches as well as percentage proportion of individual fatty acids are presented in Appendix 5 (section A5.1).

NA, not analysed; FA factor, fatty acid factor; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; TFA, trans fatty acids.

Concentrations were estimated using the hybrid bound approach. This means that medium bound concentration (0.5*limit of quantification [LOQ]) was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects.

[1] FA was not analysed in vegetables due to low total fat content (<0.5% fat). Fat content in beverages and coffee/tea were assumed to be logical zero and no analyses were performed. FAs were not analysed in subgroups pizza/hand pies.

[2] Total fat content was converted into gram fatty acids by a FA factor according to (Greenfield and Southgate, 2003), with the following exceptions: For cereal products and fruits, mean FA factors were calculated based on total fat and fatty acid contents of the individual food items in the food group, respectively. Fat content data from Swedish Food Agency´s food composition database was used. For pastries, potatoes and sugar/sweets, FA factor for fats and oils (0.96) were used because most fat were from fats and oils. For meat and processed meat, FA factor for bovine and poultry (0.95) was used because it was closest to estimated mean FA factor (0.94). For meat substitutes, FA factor for vegetables were used. For plant-based drinks, FA factor for oat was used because most of the sample was oat milk (64%).

Table 7. Concentrations of carbohydrates per kg in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
Starch[1,2] (g/kg)	Mean	507	324	7.7	34	20	0	38	0	0	10	0	0	0	8.0	141	107	0
	Min	496	309	<10	24	15	<10	33	<10	<10	<10	<10	<10	<10	<10	128	89	<10
	Median	512	318	<10	31	19	<10	36	<10	<10	12	<10	<10	<10	<10	145	107	<10
	Max	512	345	13	48	25	<10	45	<10	<10	14	<10	<10	<10	14	149	125	<10
Fibres, total (g/kg)[3]	Mean	64	33	4.3	0	3.0	10	53	NA	NA	6.7	NA	NA	24	26	100	18	NA
Fibres, total (g/MJ)[3]	Mean	4.8	2.0	0.58	0	0.78	1.1	6.8	NA	NA	2.8	NA	NA	16	6.4	27	1.1	NA
HMWDF + resistant starch (g/kg)	Mean	51	26	3.0	0	3.0	4.3	44	NA	NA	4.0	NA	NA	21	24	96	14	NA
	Min	49	24	<4	<4	<4	<4	43			3			19	24	84	13	
	Median	49	26	<4	<4	<4	4	44			4			21	24	102	14	
	Max	56	29	5	<4	5	7	45			5			22	25	102	14	
LMWDF (g/kg)	Mean	13	6.7	1.3	0	0	6.0	9.3	NA	NA	2.7	NA	NA	3.7	1.7	3.7	4.0	NA
	Min	12	6	<2	<2	<2	4	9			2			3	1	3	4	
	Median	13	7	<2	<2	<2	7	9			3			4	2	4	4	
	Max	13	7	2	<2	<2	7	10			3			4	2	4	4	
Sugars, total (g/kg)[4]	Mean	50	191	8.5	13	2.3	46	15	49	9.4	33	3.1	11	58	162	9.3	560	47
Fructose (g/kg)	Mean	13	21	0.67	0	0	1.3	1.9	0.33	0	0.63	0	0.90	29	88	3.1	31	13
	Min	12	17	0.5	<0.4	<0.4	0.8	1.1	<0.4	<0.4	<0.4	<0.4	0.7	20	85	2.2	28	7.8
	Median	12	21	0.7	<0.4	<0.4	1.2	2.1	0.4	<0.4	0.8	<0.4	0.9	30	86	3.5	31	14
	Max	14	25	0.8	<0.4	<0.4	2.0	2.6	0.4	<0.4	0.9	<0.4	1.1	36	92	3.7	33	16
Glucose (g/kg)	Mean	11	21	4.9	7.4	0.70	2.5	1.1	1.4	0.30	1.5	3.1	1.1	29	74	3.0	60	12
	Min	10	18	3.7	4.6	0.6	2.2	<0.4	1.3	<0.4	0.8	3.0	0.9	27	73	1.9	55	7.5
	Median	10	21	4.9	5.7	0.6	2.4	1.4	1.4	<0.4	1.4	3.1	1.1	28	74	3.4	59	13
	Max	12	25	6.1	12	0.9	2.8	1.7	1.4	0.5	2.4	3.2	1.2	33	76	3.8	66	15

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
Galactose (g/kg)	Mean	0	0	0	0	0	0	0	2.2	0	0	0	0	0	0	0	0	0
	Min	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	2.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Median	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	2.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Max	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	2.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Sucrose (g/kg)	Mean	3.2	134	1.1	3.7	0	42	2.4	5.8	0	8.2	0	6.4	0	0	0.90	413	23
	Min	3.0	119	0.7	2.3	<0.4	35	<0.4	5.7	<0.4	7.7	<0.4	5.4	<0.4	<0.4	<0.4	391	13
	Median	3.1	134	0.9	2.7	<0.4	40	3.2	5.7	<0.4	7.8	<0.4	6.7	<0.4	<0.4	<0.4	402	26
	Max	3.4	148	1.7	6.2	<0.4	52	3.9	5.9	<0.4	9.2	<0.4	7.1	<0.4	<0.4	2.3	445	29
Maltose (g/kg)	Mean	24	9.4	1.1	0.97	1.6	0	9.2	0	0	22	0	0	0.53	0.37	2.2	17	0
	Min	21	8.4	0.9	0.7	<0.4	<0.4	5.5	<0.4	<0.4	20	<0.4	<0.4	0.5	<0.4	0.8	11	<0.4
	Median	22	9.6	1.0	0.8	1.0	<0.4	8.6	<0.4	<0.4	23	<0.4	<0.4	0.5	<0.4	1.7	18	<0.4
	Max	29	10	1.3	1.4	3.7	<0.4	14	<0.4	<0.4	23	<0.4	<0.4	0.6	0.7	4.2	23	<0.4
Lactose (g/kg)	Mean	0	6.0	0.77	0.57	0	0	0	39	9.1	0	0	2.3	0	0	0	39	0
	Min	<0.4	5.3	0.6	<0.4	<0.4	<0.4	<0.4	39	8.5	<0.4	<0.4	2.2	<0.4	<0.4	<0.4	31	<0.4
	Median	<0.4	6.0	0.7	<0.4	<0.4	<0.4	<0.4	40	8.9	<0.4	<0.4	2.2	<0.4	<0.4	<0.4	32	<0.4
	Max	<0.4	6.8	1.0	1.3	<0.4	<0.4	<0.4	40	10	<0.4	<0.4	2.5	<0.4	<0.4	<0.4	55	<0.4

1 g/kg = 0.1 g/100 g. No analyses were performed in the food groups pizza/hand pies, and coffee/tea.

NA, not analysed; HMWDF, high molecular weight dietary fibre; LMWDF, low molecular weight dietary fibre. < indicates a value below limit of quantification (LOQ). When calculating mean hybrid bound approach was used. This means that medium bound concentration (0.5*LOQ) was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculation mean.

[1] Resistant starch was not included in the analysis.

[2] Free glucose was included in the starch analysis for the food groups meat, processed meat, lean and fatty fish, lean and fatty dairy products, egg, fats and oils.

[3] Total fibres were calculated as the sum of HMWDF and LMWDF.

[4] Total sugars were calculated as the sum of fructose, glucose, galactose, sucrose, maltose and lactose.

8.2.2 Exposure estimations and time trends

Estimated mean intake of macronutrients, fatty acids, and different carbohydrates in the Swedish population are presented in Table 8, Table 9, and Table 10. The proportional contribution of each food group to the per capita intakes of energy and proteins are presented in Figure 3. The contribution of food groups to intakes of fatty acids and different carbohydrates are illustrated in Figure 4, Figure 5, and Figure 6. Time trends of per capita intakes in comparison with previous market basket studies are shown in Figure 7.

Energy

The estimated per capita intake in the Market Basket 2022 was 12 MJ/day (Table 8). This was higher than reported in Riksmaten adults 2010-11 (8.3 MJ/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (8.9 MJ/day (Warensjö Lemming et al., 2018a)). This is not surprising because the market basket studies do not consider food waste and therefore tend to overestimate the consumption. In contrast, food consumption is often underreported in dietary surveys and energy intake is often difficult to assess accurately (Poslusna et al., 2009). Estimated total energy intake in the Market Basket 2022 was slightly lower than estimated in the Market Basket 2015 (Figure 7). This is explained by a lower total amount of per capita consumption in the present study (1.9 kg vs 2.0 kg per person per day if coffee and tea was excluded). Similar MJ per kg food was seen in both studies (6.4 MJ/kg in Market Basket 2022 and 6.2 MJ/kg in Market Basket 2015). One contributing factor to the lower amount of consumed food in the Market Basket 2022 compared with previous could be reduced amount of food waste in Sweden (Hultén et al., 2024). Cereal products (25%), meat (12%), and fats/oils (12%) contributed the most to the per capita intake of energy (Figure 3). The distribution of energy intake between macronutrients were in accordance with results from Riksmaten adults 2010-11 (Amcoff et al., 2012) and Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018a) (Table 8).

Protein

The estimated per capita intake of protein was 107 g/day, corresponding to 15 E% (Table 8). This was similar as in Market Basket 2015 (Figure 7), but higher than reported in the Riksmaten surveys (81 g/day (Amcoff et al., 2012) and 88 g/day (Warensjö Lemming et al., 2018a), respectively). However, when adjusting for energy intake, comparable energy percentage intakes of protein were observed (17 E% (Amcoff et al., 2012, Warensjö Lemming et al., 2018a)). Meat (32%), cereal products (23%), and fatty dairy products (12%) contributed to two-thirds of the protein intake (Figure 3).

Fat and fatty acids

Estimated mean total fat intake in the Swedish population was 122 g/day (Table 9), corresponding to 38 E% (Table 8). This was higher than the intakes in the Riksmaten surveys (85 g/d [35 E%] (Amcoff et al., 2012), and 77 g/day [34 E%] (Warensjö Lemming et al., 2018a). Almost two-thirds of the total fat intake were from the food groups fats/oils (30%), meat (18%), and fatty dairy products (14%) (Figure 4). The majority of the fatty acid intake was SFA and MUFA (39% and 44% of total fatty acids, respectively), see Table 9. The estimated per capita intake of SFA was 45 g per day corresponding to 14 E%. The per capita intakes of MUFA and PUFA were 50 g per day (16 E%) and 17 g per day (5 E%), respectively. Of the PUFA, about 80% were n-6 PUFA (13 g/d, 4 E%) and 20% were n-3 PUFA (4 g/day, 3 E%). The absolute intakes were higher than observed in the Riksmaten surveys, whereas the intakes in terms of E% were similar (Table 9) (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). Estimated intake of TFA was 1.7 g per day, corresponding to 0.5 E%. The intake of TFA is not determined in the Riksmaten surveys, why no comparisons could be made.

Contributions of each food group to estimated intake of different fatty acids are illustrated in Figure 4. Fatty dairy products, fats/oils and meat were the major contributors to the per capita intakes of SFA, MUFA and TFA. Almost half of the TFA intake was from fatty dairy products. Most of the per capita intake of PUFA (total, n-3 and n-6) were attributed to fats/oils (37-56%). The second largest contributor was cereals for total PUFA and for n-6 PUFA (approximately 15%), whereas it was fatty fish for n-3 PUFA (12%).

There were no major time trends for the fatty acid intakes (Figure 7). Even though there was a small decrease in total fat intake compared to the Market Basket 2015, the decrease was general across most food groups and the energy percentage was similar between the studies (38 E%). Both the fat content and the per capita intake of fat from sugar/sweets were decreased compared to the Market Basket 2015, but this was attributed to that fatty dressings were included in sugar/sweets in the Market Basket 2015 and fats/oils in the Market Basket 2022 (see Table 3).

Estimated per capita intake of TFA was slightly higher in the present market basket study compared with the Market Basket 2015 (1.7 g/day and 0.5 E% vs 1.0 g/day and 0.3 E%) (Swedish Food Agency, 2017). There was however no time trend in per capita intakes across all market basket studies and the current TFA intake was in line with data from 2010 (Figure 7). The slightly higher estimated intake seems to be attributed to higher concentrations of TFA in meat, fatty dairy products and fats/oils. It may be explained by higher proportion of bovine meat in the meat group and a reduced proportion of oils in fats/oils.

Carbohydrates and dietary fibres

Total carbohydrates

The per capita intake of total carbohydrates was about 306 g/day (Table 10), corresponding to 44 E% (Table 8). Total intake was higher than reported in the Riksmaten surveys (212 g/day (Amcoff et al., 2012) and 242 g/day (Warensjö Lemming et al., 2018a)), but when adjusting for energy intake, similar energy percentages were seen (44 E% (Amcoff et al., 2012) and 46 E% (Warensjö Lemming et al., 2018a)). Cereal products contributed the most to the per capita intake of total carbohydrates (42%), followed by sugar/sweets (17%) and fruits (11%) (Figure 5).

Sugar and starch

Estimated per capita intake of starch and sugars were 164 g/day and 143 g/day. The most abundant sugar was sucrose (34%), followed by glucose and fructose (25% each). An overall decrease in glycaemic carbohydrates were indicated since 2005, but no change was seen since the latest market basket study in 2015 (Figure 7). Sugar/sweets and fruits seemed to account for most of the reduced estimated sugar intake compared with Market Basket 2015 (Swedish Food Agency, 2017). The reduction of fruits may be attributed to a reduced sugar content in jams and fruit/berry drinks. Interpretation of the reduction of sugar/sweets is limited by that ketchup was included in vegetables instead of sugar/sweets in the present market basket study compared with previous. Thereby, the sugar/sweet´s sugar concentration was increased whereas its per capita intake was decreased. Contributions of each food group to estimated intake of carbohydrate constituents are illustrated in Figure 5 and Figure 6. Cereal products contributed to 70% of the starch intake, followed by potatoes (12%) and pastries (11%). For total sugars, the major sources for per capita intake were sugar/sweets (29%), fruits (24%), and vegetables (10%).

Per capita intake of free sugars was estimated according to the procedure used in the Swedish Food Composition Database (Wanselius et al., 2019, Swedish Food Agency, 2023), see section 8.2.1. Per capita intake of free sugars in Market Basket 2022 was estimated to 89 g/day, corresponding to 12 E%. This was in accordance with energy-adjusted intake in Riksmaten adolescents 2016-17 (12 E%), whereas the absolute intake was lower in the Riksmaten survey (59 g/day) (Wanselius et al., 2019). Sugar/sweets was the major contributor to per capita intake of free sugars (43%), followed by beverages (14%), pastries (11%), and fruits (11%). No time-trend was assessed due to the uncertainties in the estimations of free sugars, but similar intake was estimated in the Market Basket 2015 (80-85 g/day of added sugars (Swedish Food Agency, 2017)). It is reasonable to compare added and free sugars as there were only minor differences in the estimated per capita intake of added and free sugars in the Market Basket 2022 (<2 g/day) (data not shown).

Dietary fibres

Estimated per capita intake of dietary fibres was 45 g/day (Table 10), corresponding to 3 E% (Table 8). In terms of per MJ, the per capita intake was 3.7 g/MJ/day. This was about 50% higher than the intakes reported in the Riksmaten surveys (2.5 g/MJ/day (Amcoff et al., 2012) and 2.1 g/MJ/day (Warensjö Lemming et al., 2018a)). However, even though the same chemical analysis (AOAC 2009.01) is used in the Market Basket 2022 and new analyses of foods in the Swedish Food Agency´s food composition database, the fibre content in many food items in the food composition database are still based on the older method (AOAC 985.29). AOAC 2009.01 includes determination of non-available oligosaccharides, which are not included in AOAC 985.29. The latter method therefore underestimates the fibre content, and subsequently also the intake. The differences between the Market Basket 2022 and the Riksmaten surveys are hence probably a consequence of different chemical analytical methods. To some extent, not considering food waste in the Market Basket 2022 may also contribute to its higher fibre intake. Change of chemical analysis also explain the increase in dietary fibre intake in the present market basket study compared to previous (Figure 7), and it is important to point out that this probably is not a true increase in per capita intake. The largest contributors to the per capita intake were cereal products (32%) and potatoes (32%) (Figure 5). Of the fibre intake, 87% was HMWDF and 13% was LMWDF. Potatoes provided most (35%) to the HMWDF intake (including resistant starch), followed by cereal products (30%) (Figure 5). Cereal products provided a major part of LMWDF (50%), followed by vegetables (16%) (Figure 5).

Whole grain content was estimated for cereal products and pastries based on product information (see section 8.2.1). Estimated per capita intake of whole grains in the Market Basket 2022 was 39 g/day (38 g from cereal products and 1.5 g from pastries). This was in line with the whole grain intake in Riksmaten adults 2010-11 (42 g/day, (Amcoff et al., 2012)). Intake among adolescents was little lower (30 g/day, (Warensjö Lemming et al., 2018b)).

Table 8. Mean daily intake of proteins and energy intake per macronutrient from food groups and total intake in the Market Basket 2022 (N=3 samples per food group).

Food group	Per capita consumption (g/person/day)		Per capita intake (g/person/day)	Energy intake (kJ/person/day)				
			Protein	Protein	Fat	Carbohydrates	Fibres	Energy
Cereal products	226		24	415	301	2173	116	3005
Pastries	55		3.9	67	322	489	15	892
		LB				35	3.6	1465
Meat	194	HB	34	582	837	40	6.7	1466
		UB				44	10	1467
		LB				39	0	494
Processed meat[1]	48	HB	6.0	102	350	44	0	496
		UB				44	2.3	496
		LB				1.8	0.20	57
Lean fish	15	HB	2.5	42	13	2.7	0.36	58
		UB				3.0	0.76	58
		LB					1.4	
Fatty fish	18	HB	3.2	54	95	14	1.5	165
		UB					1.6	
Meat substitutes	3		0.5	7.9	12	2.9	1.3	24
Lean dairy prod.	248		8.6	146	177	219	0*	541
Fatty dairy prod.	70		13	213	653	59	0*	925
Plant-based drinks	13		0.19	3.3	12	16	0.69	32
Eggs	29		3.6	62	106	4.2	0*	172
Fats and oils	55		0.28	4.7	1369	29	0*	1402
Vegetables	245		3.6	61	35	231	48	374
Fruits	215		3.7	63	214	548	45	870
Potatoes	142		3.0	50	99	254	113	517
Sugar and sweets	74		2.9	49	285	890	10	1234
		LB				218		218
Beverages	262	HB	0*	0*	0*	223	0*	223
		UB				223		223

Food group	Per capita consumption (g/person/day)		Per capita intake (g/person/day) Protein	Energy intake (kJ/person/day) Protein	Fat	Carbohydrates	Fibres	Energy
Total		**LB**	**107**[2]	**1820**	**4529**	**5183**	**354**	**11892**
		HB				**5193**	**357**	**11898**
		UB				**5198**	**360**	**11899**
Energy distribution				**15 E%**	**38 E%**	**44 E%**	**3.0 E%**	
Recommended range[3]			0.66 g/kg/d	10-20 E%	25-40 E%	45-60 E%[4]		9000/11300
Riksmaten adults[5]			81	17 E%	34 E%	44 E%	2.0 E%	8300
Riksmaten adolescents[6]			88	17 E%	35 E%	46 E%	1.6 E%	8900

0*, content was assumed to be logical zero and no analyses were performed. Macronutrients were not analysed in pizza/hand pies and coffee/tea.

LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of quantification (LOQ) is used for non-detects, except for when all three samples in one food group have concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOQ is used for non-detects).

1 Processed meat is a subgroup of meat and its consumption is included in meat. The subgroup was therefore not included when calculating total per capita intake.
2 Corresponding to 1.5 g/kg body weight/day if assuming a population mean body weight of 70 kg.
3 Recommended intake range of macronutrients for adults according to the Nordic Nutrition Recommendations (Blomhoff et al., 2023).
4 The recommendation includes fibres. Comparison with the Market Basket 2022 should therefore include per capita intake of fibres.
5 Riksmaten adults 2010-11 (Amcoff et al., 2012).
6 Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018a).

Table 9. Mean daily intake of total fat and fatty acids from food groups and total intake in the Market Basket 2022 (N=3 samples per food group).

Food group	Per capita consumption (g/person/day)		Per capita intake (g/person/day)							
			Total fat	SFA	MUFA	PUFA	n-3 PUFA	18:3 n-3	n-6 PUFA	TFA
		LB		0.77		2.4	0.32		2.0	0.00
Cereal products	226	HB	8.1	0.77	2.8	2.4	0.32	0.32	2.0	0.00
		UB		0.88		2.5	0.38		2.1	0.04
		LB		3.2	3.8	1.3	0.24		1.0	0.02
Pastries	55	HB	8.7	3.2	3.8	1.3	0.24	0.24	1.0	0.03
		UB		3.3	3.9	1.4	0.31		1.1	0.06
		LB		9.0	10	1.9	0.17		1.6	0.31
Meat	194	HB	23	9.0	10	1.9	0.17	0.17	1.6	0.31
		UB		9.4	11	2.2	0.36		1.7	0.37
		LB		3.6	4.4	0.90	0.07		0.79	0.04
Processed meat[1]	48	HB	9.5	3.6	4.4	0.90	0.07	0.06	0.79	0.04
		UB		3.8	4.5	1.0	0.14		0.83	0.08
		LB					0.04			
Lean fish	15	HB	0.34	0.3	0.13	0.08	0.04	0.01	0.04	0.00
		UB					0.05			
		LB		0.39		0.71				0.02
Fatty fish	18	HB	2.6	0.39	1.2	0.71	0.41	0.10	0.29	0.02
		UB		0.43		0.72				0.03
		LB		0.06			0.01			
Meat substitutes	3	HB	0.31	0.06	0.11	0.08	0.01	0.01	0.06	0.00
		UB		0.07			0.02			
		LB				0.14	0.03		0.07	
Lean dairy prod.	248	HB	4.8	3.2	1.1	0.14	0.03	0.03	0.07	0.18
		UB				0.22	0.07		0.10	
		LB			4.3	0.54	0.07		0.29	0.72
Fatty dairy prod.	70	HB	18	12	4.3	0.54	0.07	0.07	0.29	0.72
		UB			4.4	0.82	0.22		0.39	0.74
		LB		0.03	0.17	0.10				

Food group	Per capita consumption (g/person/day)		Per capita intake (g/person/day) Total fat	SFA	MUFA	PUFA	n-3 PUFA	18:3 n-3	n-6 PUFA	TFA
Plant-based drinks	13	HB	0.33	0.03	0.17	0.10	0.02	0.02	0.08	0.00
		UB		0.04	0.18	0.11				
		LB		0.73		0.48	0.06		0.43	0.00
Eggs	29	HB	2.9	0.73	1.2	0.49	0.06	0.03	0.43	0.00
		UB		0.78		0.52	0.07		0.44	0.02
		LB			17	7.3	2.0		4.8	0.37
Fats and oils	55	HB	37	11	17	7.3	2.0	2.0	4.8	0.37
		UB			18	7.9	2.3		5.1	0.51
Vegetables	245		0.95							
		LB		0.78		1.2	0.12			0.00
Fruits	215	HB	5.8	0.78	3.4	1.2	0.12	0.12	1.1	0.00
		UB		0.88		1.3	0.17			0.03
		LB		0.48		0.61	0.03		0.58	0.00
Potatoes	142	HB	2.7	0.48	1.5	0.61	0.03	0.03	0.58	0.00
		UB		0.53		0.66	0.05		0.60	0.02
		LB		3.9		0.58	0.02		0.49	0.04
Sugar and sweets	74	HB	7.7	3.9	2.9	0.58	0.02	0.02	0.49	0.04
		UB		4.0		0.71	0.09		0.55	0.07
Beverages	262		0*							
		LB		**45**	**50**	**17**	**3.5**		**13**	**1.7**
Total		**HB**	**122**	**45**	**50**	**17**	**3.5**	**3.1**	**13**	**1.7**
		UB		**46**	**51**	**19**	**4.5**		**14**	**2.1**
% of total FA				**39%**	**44% (43-44)**	**15% (15-16)**	**3.1% (3.1-3.8)**	**2.8% (2.7-2.8)**	**11%**	**1.5% (1.5-1.7)**
Energy distribution (E%)			**38 E%**	**14 E%**	**16 E%**	**5.4 E% (5.4-6.0)**	**1.1 E% (1.1-1.4)**	**1.0 E%**	**4.0 E% (4.0-4.2)**	**0.5 E% (0.5-0.6)**
Recommended range[2]			20-40 E%	<10 E%	10-20 E%	5-10 E%	1 E%	0.5 E%	3 E%	As low as possible
Riksmaten adults[3]			34 E%	13 E%	13 E%	5.6 E%	1.2 E%		4.2 E%	
Riksmaten adolescents[4]			35 E%	14 E%	14 E%	4.7	1.0 E%	0.8 E%	3.6 E%	

SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; TFA, trans fatty acids. LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of quantification (LOQ) is used for non-detects, except for when all three samples in one food group have concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOQ is used for non-detects).

Fatty acids were not analysed in vegetables due to low total fat content (<0.5%). Fatty acids were not analysed in pizza/hand pies and coffee/tea.

[1] Processed meat is a subgroup of meat and its consumption is included in meat. The subgroup was therefore not included when calculating total per capita intake.
[2] Recommended intake range according to the Nordic Nutrition Recommendations 2023 for adults (Blomhoff et al., 2023).
[3] Riksmaten adults 2010-11 (Amcoff et al., 2012).
[4] Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

Table 10. Mean daily intake of carbohydrates from food groups and total intake in the Market Basket 2022 (N=3 samples per food group).

Food group	Per capita consump. (g/pers/day)		Per capita intake (g/person/day)												
			Total CHO	Glycaemic CHO	Starch	Total fibres	HMWDF[1]	LMWDF	Total sugars	Fru	Glu	Gal	Suc	Mal	Lac
Cereal products	226	LB							11			0			0
		HB	128	126	115	14	12	2.9	11	2.9	2.4	0	0.72	5.4	0
		UB							12			0.09			0.09
Pastries	55	LB										0			
		HB	29	28	18	1.8	1.4	0.37	11	1.2	1.2	0	7.4	0.52	0.33
		UB										0.02			
Meat	194	LB	2.1	2.5	0.84	0.45	0.32	0.13	1.6			0			
		HB	2.3	3.1	1.5	0.84	0.58	0.26	1.6	0.13	0.95	0	0.21	0.21	0.15
		UB	2.6	3.9	2.1	1.2	0.84	0.39	1.7			0.08			
Processed meat[2]	48	LB	2.3	2.2		0	0	0	0.60	0		0			0.02
		HB	2.6	2.3	1.6	0	0	0	0.61	0	0.35	0	0.18	0.05	0.03
		UB	2.6	2.3		0.29	0.19	0.10	0.65	0.02		0.02			0.03
Lean fish	15	LB	0.11	0.33		0.03	0.03	0	0.03	0		0	0	0.02	0
		HB	0.16	0.33	0.30	0.05	0.05	0	0.04	0	0.01	0	0	0.02	0
		UB	0.18	0.36		0.10	0.07	0.03	0.06	0.01		0.01	0.01	0.03	0.01
Fatty fish	18	LB	0.81	0.83	0	0.17	0.07		0.83			0		0	0
		HB	0.82	0.83	0	0.19	0.08	0.11	0.83	0.02	0.04	0	0.76	0	0
		UB	0.84	1.0	0.18	0.20	0.09		0.85			0.01		0.10	0.01
Meat substitutes	3	LB							0.04						
		HB	0.17	0.16	0.11	0.16	0.13	0.03	0.04	0.01	0	0	0.01	0.03	0
		UB							0.05						
Lean dairy prod.	248	LB		12	0					0.07				0	
		HB	13	12	0	0*	0*	0*	12	0.08	0.34	0.55	1.4	0	9.7
		UB		15	2.5					0.10				0.10	
Fatty dairy prod.	70	LB		0.65	0				0.65	0	0.01	0	0	0	
		HB	3.5	0.66	0	0*	0*	0*	0.66	0	0.02	0	0	0	0.64
		UB		1.5	0.70				0.78	0.03	0.03	0.03	0.03	0.03	
		LB		0.53	0.11				0.42			0			0

Food group	Per capita consump. (g/pers/day)		Per capita intake (g/person/day)												
			Total CHO	Glycaemic CHO	Starch	Total fibres	HMWDF[1]	LMWDF	Total sugars	Fru	Glu	Gal	Suc	Mal	Lac
Plant-based drinks	13	HB	0.92	0.56	0.13	0.09	0.05	0.03	0.42	0.01	0.02	0	0.11	0.29	0
		UB		0.59	0.16				0.43			0.01			0.01
		LB		0.09	0				0.09	0		0	0	0	0
Eggs	29	HB	0.25	0.09	0	0*	0*	0*	0.09	0	0.09	0	0	0	0
		UB		0.44	0.29				0.15	0.01		0.01	0.01	0.01	0.01
		LB		0.59	0				0.59			0		0	
Fats and oils	55	HB	1.7	0.59	0	0*	0*	0*	0.59	0.05	0.06	0	0.35	0	0.13
		UB		1.2	0.55				0.63			0.02		0.02	
		LB		14	0				14			0	0		0
Vegetables	245	HB	14	14	0	6.0	5.1	0.90	14	7.0	7.2	0	0	0.13	0
		UB		17	2.5				15			0.10	0.10		0.10
		LB		36	1.0							0	0	0.05	0
Fruits	215	HB	32	37	1.7	5.6	5.2	0.36	35	19	16	0	0	0.08	0
		UB		38	2.4							0.09	0.09	0.11	0.09
		LB							1.3			0	0.11		0
Potatoes	142	HB	15	21	20	14	14	0.52	1.3	0.44	0.43	0	0.13	0.32	0
		UB							1.5			0.06	0.15		0.06
		LB										0			
Sugar and sweets	74	HB	52	49	7.9	1.3	1.0	0.30	41	2.3	4.4	0	31	1.3	2.9
		UB										0.03			
		LB		12	0				12			0		0	0
Beverages	262	HB	13	12	0	0*	0*	0*	12	3.3	3.1	0	5.9	0	0
		UB		15	2.6				13			0.10		0.10	0.10
		LB	**305**	**305**	**163**	**44**		**5.6**	**143**			**0.55**	**47**	**8.2**	
Total		**HB**	**306**	**307**	**164**	**45**	**39**	**5.7**	**143**	**36**	**36**	**0.55**	**48**	**8.3**	**14**
		UB	**306**	**319**	**175**	**45**		**5.9**	**144**			**1.2**	**48**	**8.6**	
Riksmaten adults[3]			212			20			88				39		
Riksmaten adolescents[4]			242			18			104				46		

Per capita consump, per capita consumption; CHO, carbohydrates; HMWDF, high molecular weight dietary fibre; LMWDF, low molecular weight dietary fibre; fru, fructose; glu, glucose; gal, galactose; suc, sucrose; mal, maltose; lac, lactose. LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of quantification (LOQ) is used for non-detects, except for when all three samples in one food group have concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOQ is used for non-detects).
Total carbohydrates were calculated by difference (i.e. 1000 - water - ash - protein - fat - fibre). Glycaemic carbohydrates were calculated by sum of starch and total sugars. Total sugars were calculated by sum of fructose, glucose, galactose, sucrose, maltose, and lactose.
0*, content was assumed to be logical zero and no analyses were performed. Macronutrients were not analysed in pizza/hand pies and coffee/tea.

[1] HMWDF include resistant starch.
[2] Processed meat is a subgroup of meat and its intake is included in meat. The subgroup was therefore not included when calculating total per capita intake.
[3] Riksmaten adults 2010-11 (Amcoff et al., 2012).
[4] Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

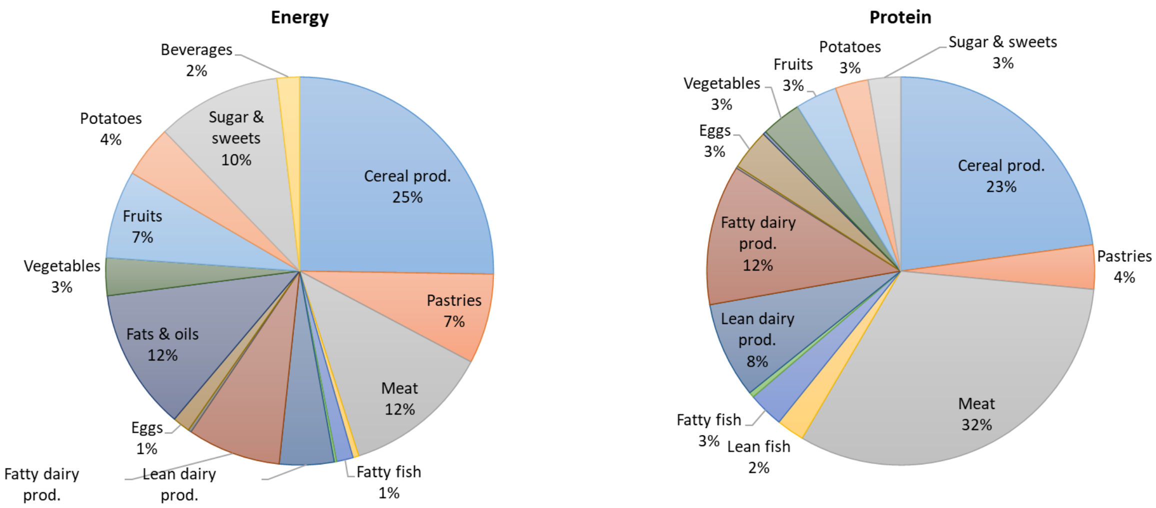

Figure 3. Percentage contribution to the per capita intake of energy and protein from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

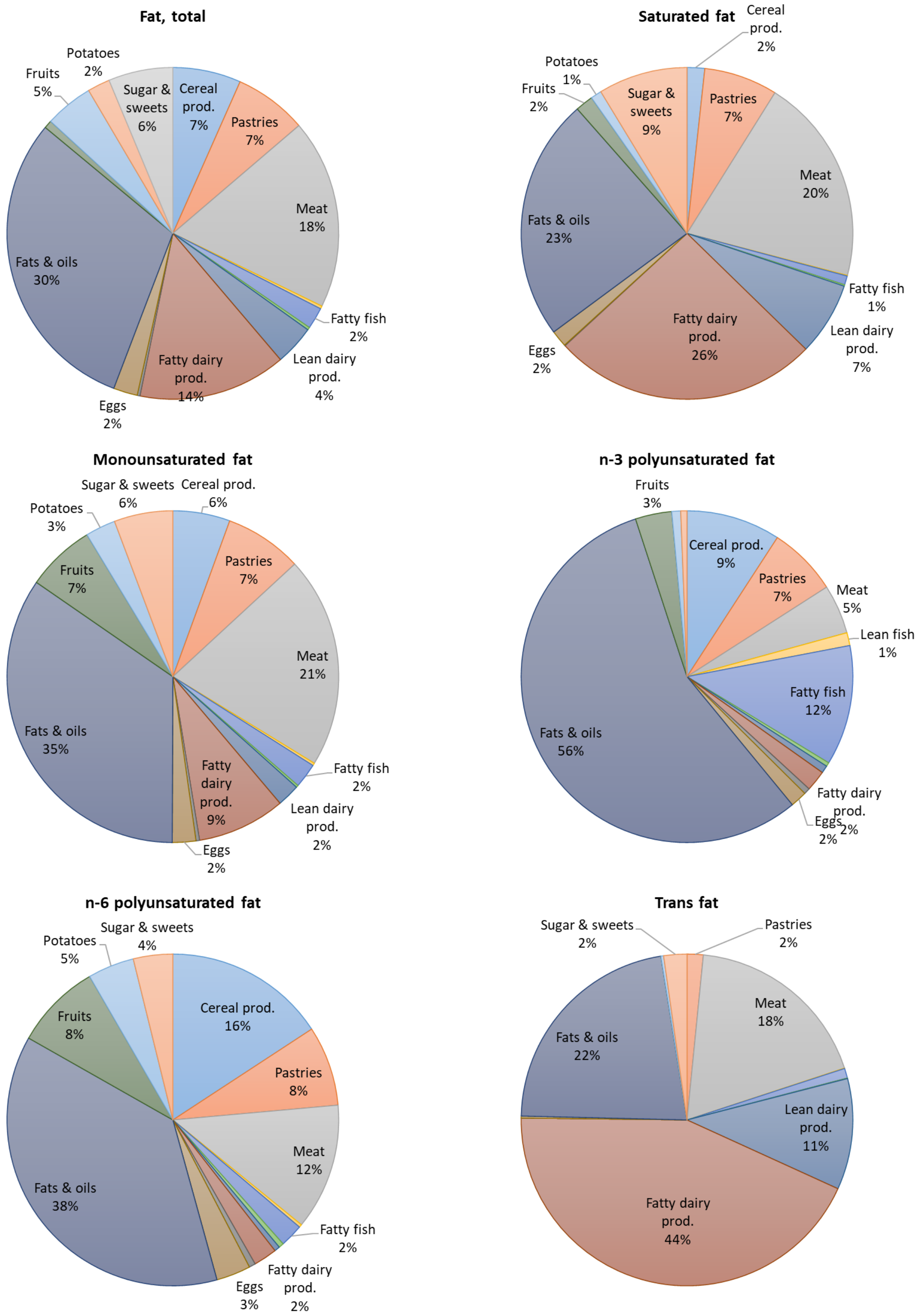

Figure 4. Percentage contribution to the per capita intake of fatty acids from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

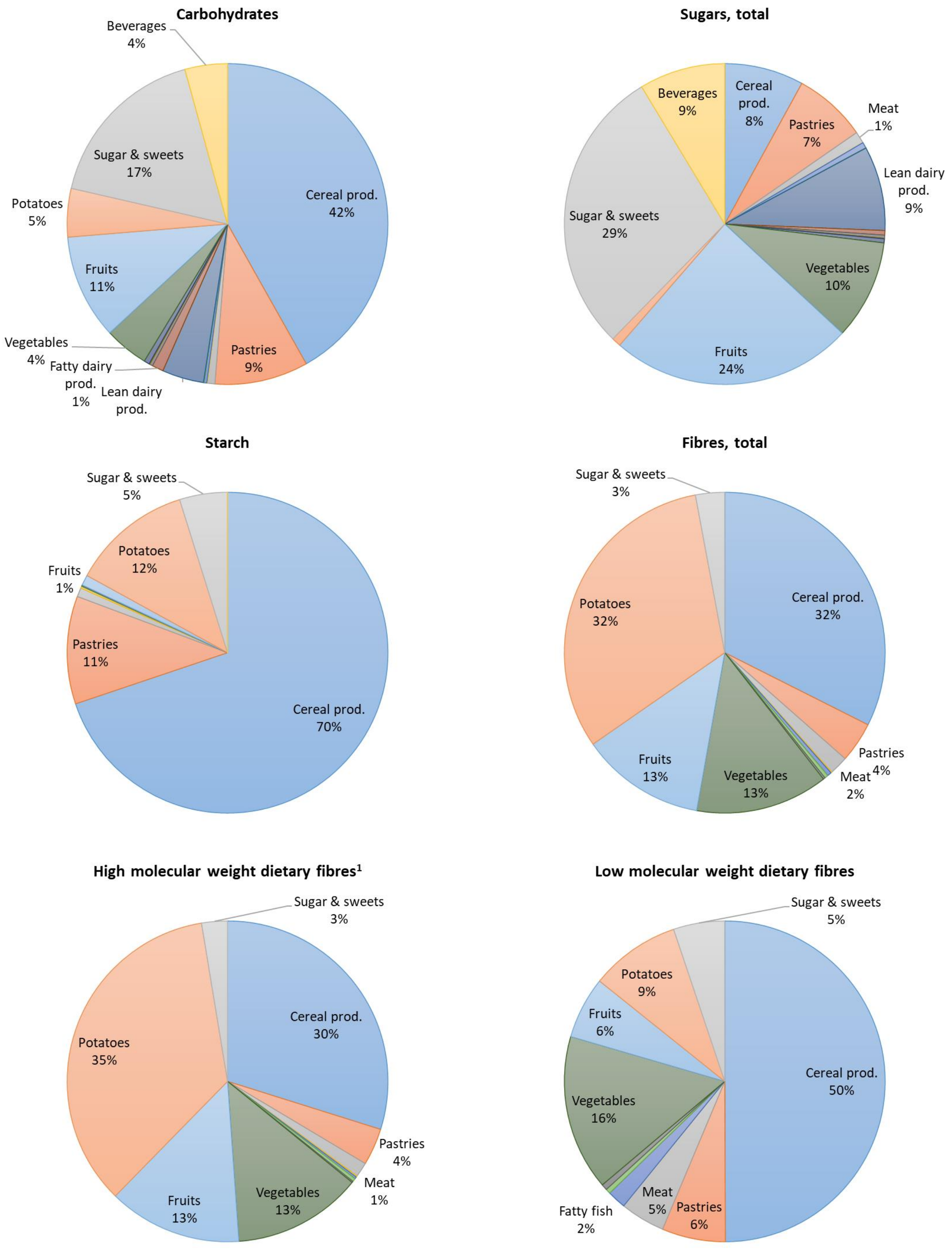

Figure 5. Percentage contribution to the per capita intake of carbohydrates and dietary fibres from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

[1] High molecular weight dietary fibres include resistant starch.

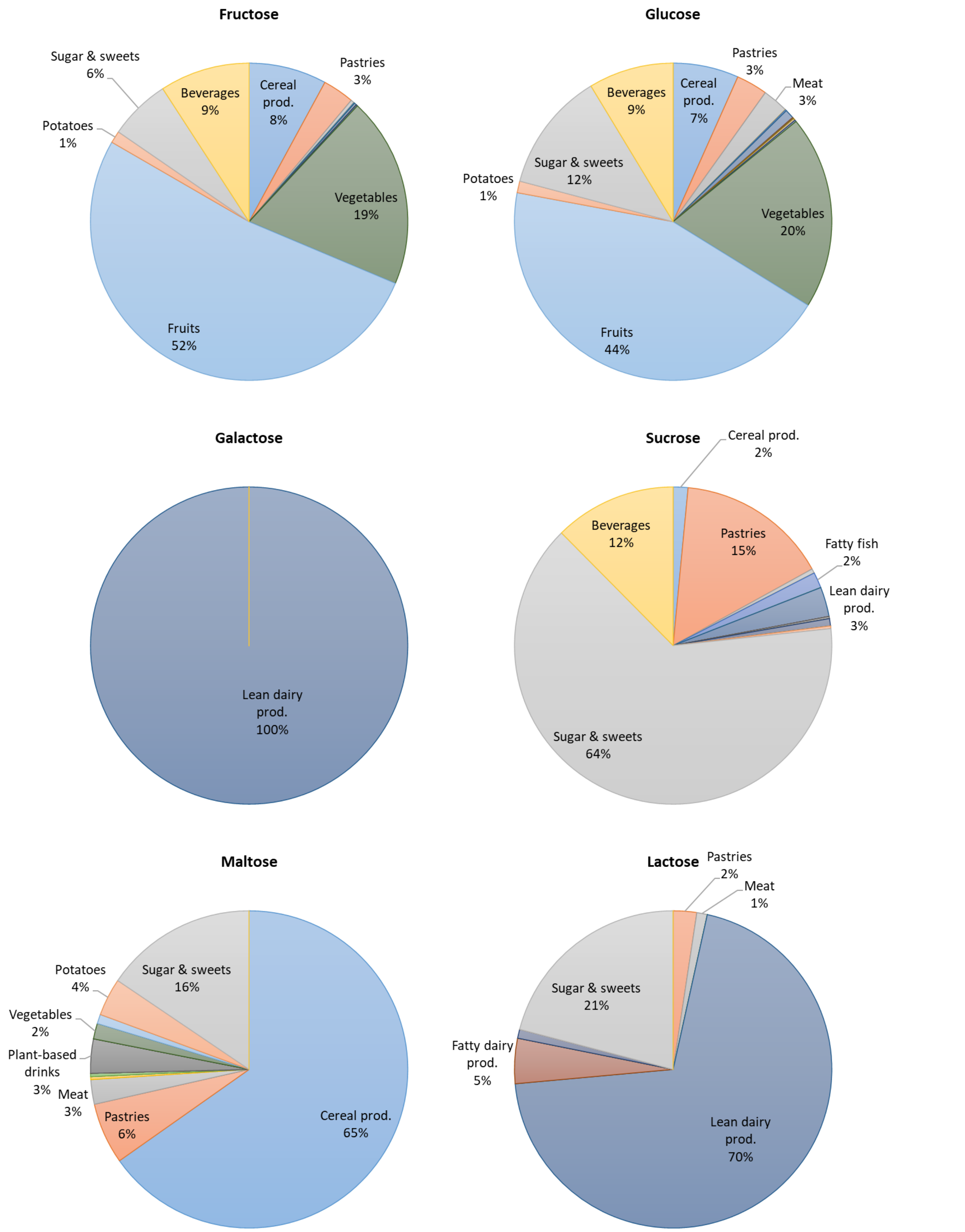

Figure 6. Percentage contribution to the per capita intake of sugars from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

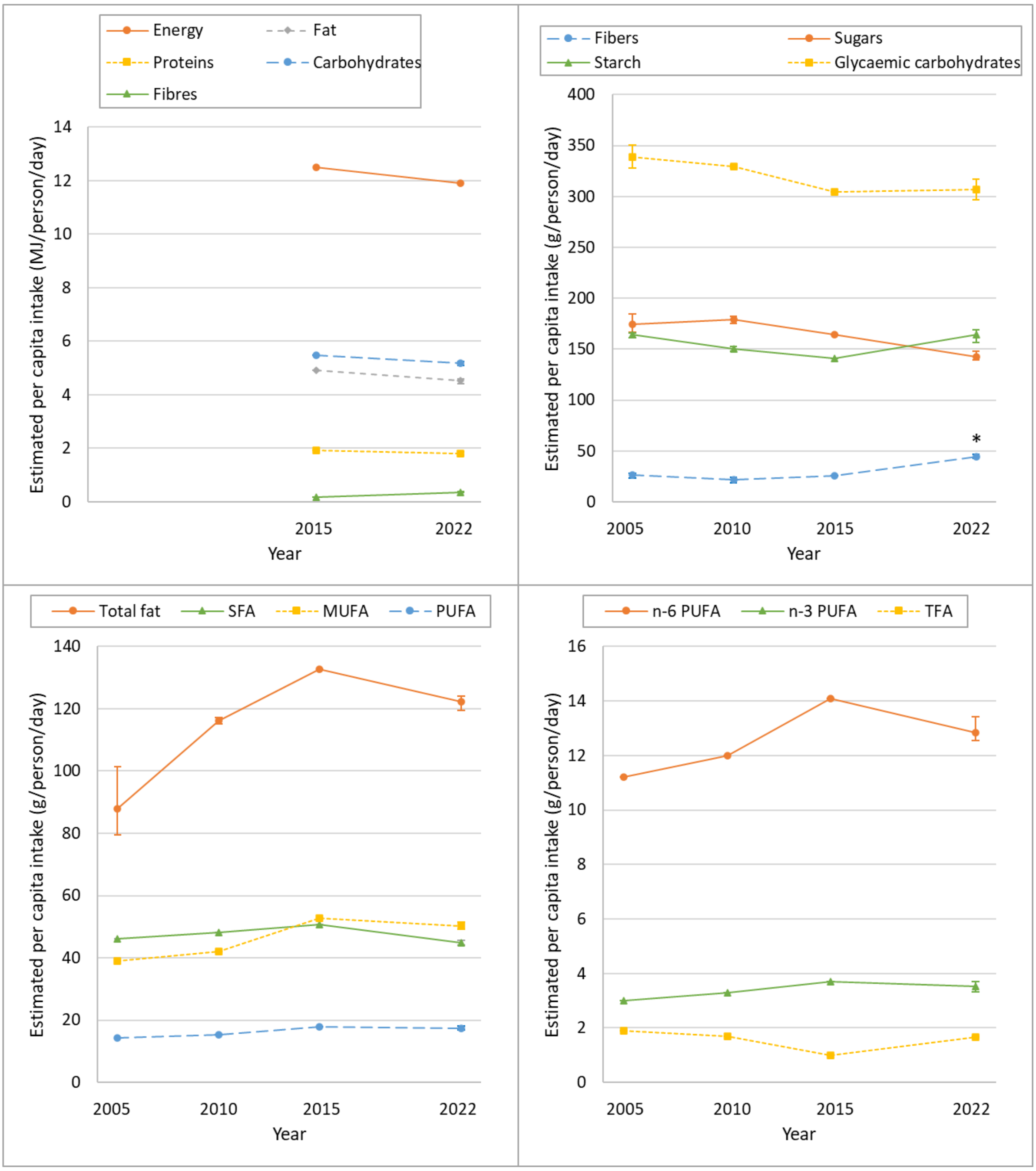

Figure 7. Estimated per capita intake of macronutrients, carbohydrates and fatty acids in market basket studies over time.

Note, that the per capita intake is a function of per capita consumption and compound concentrations in the food groups. Intake from coffee/tea was not included. Vertical lines indicate minimum and maximum values. Number of samples per food group was N=4 (2005), N=2 (2010), N=1 (2015), N=3 (2022).

* Note, another chemical method was used for analysis of dietary fibres in the Market Basket 2022 compared with previous, explaining the increase in per capita intake.

8.2.3 Risk and benefit assessments

Assessments of benefits or risks with the per capita intakes of macronutrients in the Market Basket 2022 was mainly evaluated using recommended intake ranges for adults as defined in the NNR (Blomhoff et al., 2023). These ranges are associated with reduced risk of chronic diseases while providing adequate intake of essential nutrients. The ranges are provided as guidance and not recommended intake (RI) (Blomhoff et al., 2023). Figure 8 shows the estimated per capita intakes of macronutrients in the Market Basket 2022 in relation to the reference intake ranges in the NNR.

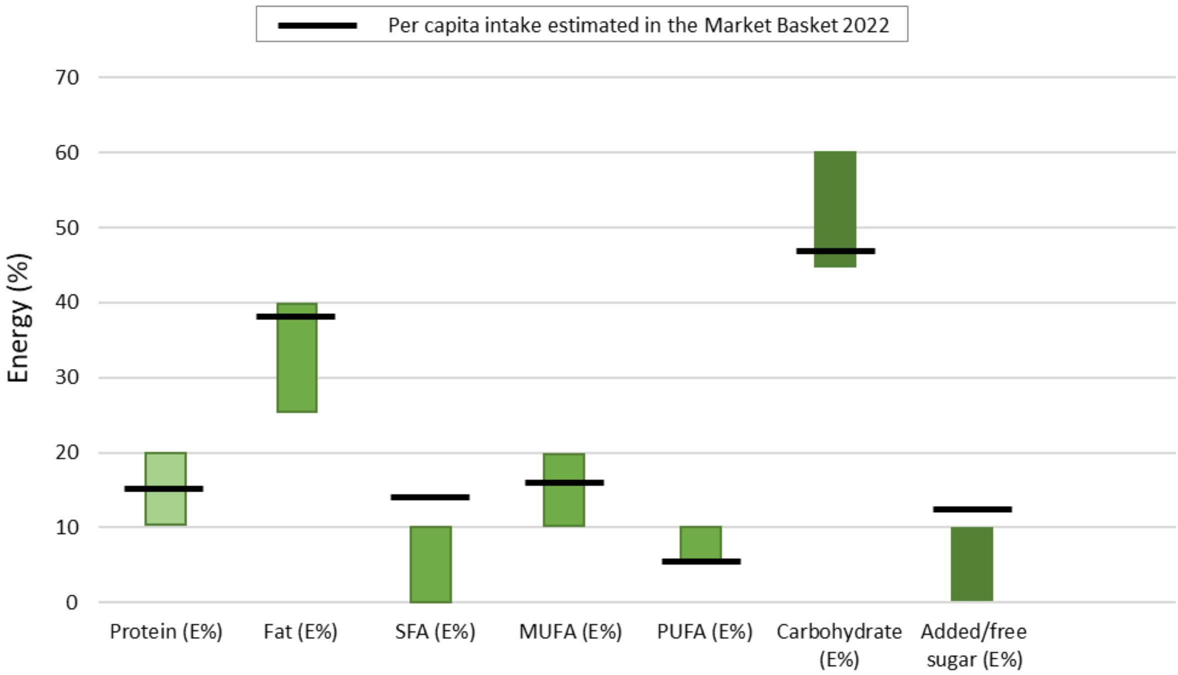

Figure 8. Estimated per capita intake in the Market Basket 2022 in relation to reference intake ranges of macronutrients (Blomhoff et al., 2023).
SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids. Per capita intake of dietary fibres is included in carbohydrates in accordance with the Nordic Nutrition Recommendations.

Energy

Estimated per capita intake of energy in the Market Basket 2022 (12 MJ/day, Table 8) was higher than the reference values in the NNR (mean: 10 MJ/day, 9 MJ and 11 MJ for females and males, respectively (Blomhoff et al., 2023)). It is important to keep in mind that the market basket study investigates the energy supply and not energy intake in the population. It is therefore difficult to draw any conclusions regarding the energy intake in the Swedish population. Nevertheless, an intake of 12 MJ/day is in line with the refence value for a physically active young man and a large part of the population has reference energy intakes below 10 MJ/day (Blomhoff et al., 2023). Assuming a 15% overestimation in the Market Basket 2022, would mean an intake of 10 MJ/day.

The distribution of energy percentage between macronutrients (15 E% protein, 38 E% fat, 47 E% carbohydrates, Table 8 and Figure 8) were in agreement with the NNR, but fat intake was in the upper range and carbohydrates in the lower range. Energy from alcohol was not included in the Market Basket 2022.

Protein

Protein provides amino acids for protein synthesis in the body, essential for building of cells, production of enzymes and hormones. Proteins also provide energy. There are 20 amino acids, whereof 9 cannot be produced in the body and are essential. The energy percentage of protein (15 E%, Table 8) was in agreement with 10-20 E% as recommended by the NNR (Blomhoff et al., 2023). Average requirement (AR) and recommended intake (RI) are set for protein based on nitrogen balance. The protein intake (1.5 g/kg/day, Table 8) was about double as high as average requirement (AR) (0.66 g/kg/day) and recommended intake (RI) (0.83 g/kg/day) according to the NNR (Blomhoff et al., 2023), if assuming a mean body weight of 70 kg (see section 7.1.3).

Fat and fatty acids

Fat is needed as a source of energy and for absorption of the fat-soluble vitamins A, D, E, and K. Fats are mainly present in food in the form of triglycerides. Triglycerides are composed of a glycerol molecule and three fatty acids. There are two essential fatty acids, which cannot be produced in the body and must therefore be provided via food. These are linoleic acid (18:2 n-6) and alpha-linolenic acid (18:3 n-3). Partial replacement of SFA with n-6 PUFA improves plasma lipid profile and decreases the risk of cardiovascular disease (Blomhoff et al., 2023). Long-chain n-3 PUFA have also beneficial effects on plasma triglycerides and risk of cardiovascular disease (Blomhoff et al., 2023). TFA impairs blood lipid profile and is positively associated with cardiovascular disease and total mortality (Retterstol and Rosqvist, 2024).

Estimated mean energy percentage of total fat intake in the Swedish population (38 E%, Table 8) was within the recommendation (25-40 E%) (Blomhoff et al., 2023). The estimated per capita intake of SFA (14 E%) was higher than the recommended intake range of less than 10 E% (Blomhoff et al., 2023), which also agrees with results from the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). Intakes of MUFA (16 E%) and PUFA (5 E%) were in accordance with recommended intake ranges (10-20 E% and 5-10 E%, respectively). Recommended intakes of at least 3 E% n-6 PUFA, 1 E% n-3 PUFA and 0.5 E% α-linolenic acid (18:3 n-3) were also reached by the estimated per capita intakes (4 E%, 1 E%, and 1 E%) (Becker et al., 2011). The NNR recommends TFA to be as low as possible. The estimated intake in the Market Basket 2022 was 0.5 E%.

Carbohydrates and fibres

Carbohydrates

Carbohydrates are a major source of energy. There are four main groups of carbohydrates as defined chemically: monosaccharides (glucose, fructose, and galactose), disaccharides (sucrose, lactose, and maltose), oligosaccharides, and polysaccharides. “Sugars” refer to monosaccharides and disaccharides. The per capita intake of carbohydrates in the Market Basket 2022 was 47 E%, if also including fibres (Table 8), and hence within the lower range of the NNR recommendations (45-60 E%) (Blomhoff et al., 2023).

The quality of carbohydrates is affected by the proportion of added or free sugar and dietary fibre content. Added/free sugars are associated with risk for chronic metabolic diseases, dental caries, and leave less room for healthy food which provides micronutrients. It is therefore recommended that the intake of added and free sugars should be below 10 E%, and preferentially lower (Blomhoff et al., 2023). The estimated population mean intake in the Market Basket 2022 was higher (12 E%), indicating a need for an overall reduced intake in the Swedish population. This is also in line with results from Swedish adolescents (Wanselius et al., 2019).

Dietary fibres

A high intake of fibres is associated with lower all-cause mortality, as well as lower risk of coronary heart disease, colorectal cancer, stroke and type 2 diabetes. Fibres may also increase nutrient intake and satiety. The recommended intake of fibres is 3-3.5 g/MJ/day (Blomhoff et al., 2023). A per capita intake above the recommendation was observed in the Market Basket 2022 (3.7 g/MJ/day), indicating a sufficient mean intake of fibres in the population. However, because different fibre analyses include different types of fibres, this comparison should be interpreted with caution. The estimated intake in the Market Basket 2022 was based on a method giving higher fibre concentrations, whereas older fibre methods measuring lower content can be assumed in many of the scientific studies used in the evaluation in the NNR. In comparison, previous estimations of the per capita intake and intakes in adults and adolescents were 2-2.5 g/MJ/day (Swedish Food Agency, 2017, Warensjö Lemming et al., 2018a).

Whole grains lower the risks of cardiovascular disease, colorectal cancer, type 2 diabetes and premature mortality (Blomhoff et al., 2023). The estimated per capita intake of whole grains in the Market Basket 2022 (39 g/day) was much lower than the recommendation of at least 90 g/day (Blomhoff et al., 2023).

8.2.4 Conclusion

The Market Basket 2022 only estimates the energy supply and not the energy intake in the population (i.e. consumption data is used instead of information from consumers about their actual food consumption). This limits the interpretation of energy intake. The distribution of energy percentage between macronutrients agreed with recommendations.

SFA was higher than recommendations whereas MUFA, PUFA, n-3 and n-6 PUFA were in line with the recommendations. Even though the estimated per capita intake of TFA was slightly higher in the Market Basket 2022 compared with the Market Basket 2015, there was no overall time trend and the estimated intake was low (e.g. 0.5 E%).

Estimated mean intake of free sugars in the population are higher than the recommendations. A higher mean fibre intake compared with the previous market basket was observed, but this result is difficult to interpret considering differences in assessed fibre concentrations between different chemical analysis methods. Estimated per capita intake of whole grains based on product information indicated a mean whole grain intake less than half of what is recommended.

8.3 Vitamins

Vitamins are a group of varied organic compounds essential in human diet to maintain normal metabolism and function of several chemical reactions in the body. All four fat-soluble vitamins (A, D, E, and K) and three water-soluble vitamins (thiamin, riboflavin and folate) were determined in the Market Basket 2022. The fat-soluble vitamins were analysed at the Swedish Food Agency, and the water-soluble vitamins were analysed at Eurofins Vitamin Testing in Denmark. All laboratories were accredited. Briefly, retinols and vitamin D were determined using HPLC-ultraviolet. Tocopherols/tocotrienols and vitamin K were analysed by HPLC-fluorescence detector, and carotenoids were determined by HPLC-diode-array detection. Thiamin and riboflavin concentrations were analysed using HPLC. Folate was determined by a microbiological assay. Measurement uncertainties, and LOQs are shown in Table 11. The chemical analyses are described in more detail in Appendix 4 (section A4.2).

Vitamin A content was determined by retinol and carotenoids in terms of retinol equivalents (RE) and calculated as follows: RE = (µg trans-all-retinol + β-carotene/6 + (α-carotene + β-cryptoxanthin)/12) (EFSA Panel on Dietetic Products et al., 2015, Blomhoff et al., 2023). Vitamin D content was determined by vitamin D_3 concentration (cholecalciferol), with exception of plant-based drinks which were determined by vitamins D_2 (ergocalciferol). Vitamin K content was calculated as the sum of vitamins K1 (phylloquinone) and K2 (menaquinone-4).

Table 11. Limits of quantification (LOQ) and measurement uncertainty for methods used for determination of vitamins in the Market Basket 2022.

Substance	LOQ (µg/kg)	Measurement uncertainty (%)
Vitamin A - retinol	24	± 9-18
Vitamin A – carotenoids	50	± 12-18
Vitamin D	3	± 7-14
Vitamin E	130	± 8-18
Vitamin K	10	± 9-16
Thiamin	180	± 16
Riboflavin	100	± 16
Folate	50	± 30

1 g/kg = 0.1 g/100 g.

8.3.1 Concentrations in food groups

Concentrations of vitamin A (retinol, carotenoids), vitamin D (cholecalciferol, ergocalciferol), vitamin E (α-tocopherols), vitamin K (K1, K2), thiamin (vitamin B1), riboflavin (vitamin B2), and folate (vitamin B9) in the different food groups in the Market Basket 2022 are presented in Table 12. Concentrations of carotenoids (lutein, lycopene, xeaxanthine) and tocopherols (β-, δ-, γ-tocopherol and α-, β-, δ-, γ-tocotrienol) not included in the calculations of vitamin A and vitamin E, respectively, are presented in Appendix 5 (section A5.2).

EU regulation for nutrient claims (Regulation (EC) No 1924/2006) defines a significant amount of a vitamin in relation to recommended daily allowance values (RDA) described in EU regulation 1169/2011 (Regulation (EU) No 1169/2011). Significant amount for a food product is considered to be 15% of RDA per 100g or 100 ml, and for a beverage product 7.5% of RDA per 100 ml. The purpose of the regulation is to harmonise the provisions for nutrition and health claims for commercial communication of individual products. An evaluation of the nutrient content of the food groups in the Market Basket 2022 was done using the EU regulation 1169/2011 (Regulation (EU) No 1169/2011). It should however only be considered as an indication because it is on food group level.

Vitamin A

The highest amounts of retinol were found in the food groups fats/oils, fatty dairy products, and meat, while the highest amounts of carotenoids were found in the group for vegetables, and fats/oils (Table 12). The RE in these four food groups corresponded to the criterion for significant amount, i.e. more than 15% of the nutrient reference value for retinol (800 µg/100 g) (Regulation (EU) No 1169/2011).

Vitamin D

The highest contents of vitamin D were found in fatty fish and fats/oils (Table 12). Fatty fish, lean dairy products, plant-based drinks, eggs and fats/oils had vitamin D contents that fulfilled the criterion for significant amount, i.e. content higher than 15% of the nutrient reference value (5 µg/100 g) (Regulation (EU) No 1169/2011).

Vitamin E

The highest concentration of vitamin E (α-tocopherol) was found in fats/oils, followed by eggs, and fatty fish (Table 12). Pastries, fatty fish, meat substitutes, eggs and fats/oils had vitamin E content higher than 15% of the nutrient reference value (12 mg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Vitamin K

Vitamin K was expressed as the sum of vitamin K1 (phylloquinone) and vitamin K2 (menaquinone-4). The highest concentrations of vitamin K were found in fats/oils, vegetables, and eggs (Table 12). The contents in the food groups meat, eggs, fats/oils, and vegetables were higher than 15% of the nutrient reference value for vitamin K (75 µg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Thiamin (vitamin B1)

High concentrations of thiamin were found in meat, meat substitutes, and cereal products (Table 12). The thiamin contents of the food groups meat and meat substitutes corresponded to more than 15% of the nutrient reference value (1.1 mg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Riboflavin (vitamin B2)

Eggs had the highest concentrations of riboflavin, followed by plant-based drinks and fatty dairy products (Table 12). These three food groups had riboflavin content of more than 15% of the nutrient reference value (1.4 mg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Folate (vitamin B9)

The highest concentrations of folate were found in eggs, meat substitutes, and cereal products (Table 12). The folate contents of eggs and meat substitutes corresponded to more than 15% of the nutrient reference value (200 µg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Table 12. Concentrations of vitamins[1] in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
Vitamin A[2] (RE/kg)	Mean	0	228	1222	0	83	35	185	2469	7.7	588	5379	2227	154	0	184	0
	Min	<LOQ	108	977	<LOQ	65	17	167	2375	4.2	563	5180	2115	104	<LOQ	159	<LOQ
	Median	<LOQ	189	1120	<LOQ	69	44	186	2487	4.2	568	5290	2256	145	<LOQ	193	<LOQ
	Max	<LOQ	386	1570	<LOQ	116	45	201	2546	15	631	5667	2310	213	<LOQ	200	<LOQ
All-trans-retinol (µg/kg)	Mean	0	102	1222	0	83	0	170	2330	0	581	4983	0	0	0	166	0
	Min	<60	60	977	<60	65	<60	155	2240	<60	556	4780	<60	<60	<60	147	<60
	Median	<60	103	1120	<60	69	<60	171	2340	<60	563	4920	<60	<60	<60	171	<60
	Max	<60	144	1570	<60	116	<60	184	2410	<60	624	5250	<60	<60	<60	180	<60
β-carotene (µg/kg)	Mean	0	676	0*	0*	0*	211	87	835	46	0	2373	11100	476	0	109	0*
	Min	<50	273				101	70	812	<50	<50	2220	10800	296	<50	72	
	Median	<50	504				263	88	815	<50	<50	2400	11200	564	<50	80	
	Max	<50	1250				269	103	879	88	<50	2500	11300	568	<50	176	
α-carotene (µg/kg)	Mean	0	153	0*	0*	0*	0	0	0	0	0	0	4413	127	0	0	0*
	Min	<50	<50				<50	<50	<50	<50	<50	<50	3660	109	<50	<50	
	Median	<50	<50				<50	<50	<50	<50	<50	<50	4310	127	<50	<50	
	Max	<50	408				<50	<50	<50	<50	<50	<50	5270	146	<50	<50	
β-cryptoxanthin (µg/kg)	Mean	0	0	0*	0*	0*	0	0	0	0	79	0	109	768	0	0	0*
	Min	<50	<50				<50	<50	<50	<50	64	<50	53	485	<50	<50	
	Median	<50	<50				<50	<50	<50	<50	86	<50	114	548	<50	<50	
	Max	<50	<50				<50	<50	<50	<50	87	<50	159	1270	<50	<50	
Vitamin D[3] (µg/kg)	Mean	0	0	0	4.7	73	0	11	0	9.8	14	64	0*	0*	0*	0	0*
	Min	<3	<3	<3	3.7	61	<3	10	<3	7.8	13	55				<3	
	Median	<3	<3	<3	4.1	71	<3	11	<3	10	14	59				<3	
	Max	<3	<3	<3	6.2	87	<3	11	<3	11	14	79				<3	

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
Vitamin E	Mean	9.0	31	7.6	18	40	20	0.6	6.3	8.2	53	134	5.7	8.6	3.7	10	4.3
(α-tocopherol)	Min	7.1	30	4.5	16	37	8.8	0.47	6.2	7.3	53	131	5.2	6.8	3.6	9.3	3.5
(mg/kg)	Median	8.6	30	7.3	18	41	26	0.58	6.2	8.4	53	133	5.6	9.4	3.8	9.5	4.1
	Max	11	33	11	19	41	26	0.88	6.5	8.8	54	138	6.2	9.6	3.8	12	5.3
Vitamin K[4]	Mean	19	62	156	8.2	57	88	0	103	40	222	558	243	39	23	19	0*
(µg/kg)	Min	16	52	149	5.0	51	49	<LOQ	97	31	214	536	220	38	18	18	
	Median	16	58	150	5.0	53	101	<LOQ	102	34	224	550	247	39	19	20	
	Max	25	76	170	15	68	115	<LOQ	110	55	227	590	262	41	31	21	
Vitamin K1	Mean	19	62	17	8.2	34	88	0	22	40	0	502	243	39	23	19	0*
(µg/kg)	Min	16	52	11	<10	27	49	<10	21	31	<10	486	220	38	18	18	
	Median	16	58	17	<10	35	101	<10	22	34	<10	486	247	39	19	20	
	Max	25	76	22	15	41	115	<10	24	55	<10	535	262	41	31	21	
Vitamin K2	Mean	0	0	139	0	23	0	0	81	0	222	56	0	0	0	0	0*
(µg/kg)	Min	<10	<10	131	<10	18	<10	<10	75	<10	214	51	<10	<10	<10	<10	
	Median	<10	<10	139	<10	23	<10	<10	81	<10	224	54	<10	<10	<10	<10	
	Max	<10	<10	148	<10	27	<10	<10	86	<10	227	64	<10	<10	<10	<10	
Thiamin	Mean	1.3	0.78	2.9	0.35	1.2	1.7	0	0	0.23	0.66	0	0.42	0.30	0.52	0.17	0
(vitamin B1)	Min	1.2	0.67	2.8	0.30	1.1	1.3	<0.18	<0.18	0.19	0.66	<0.18	0.35	0.23	0.47	<0.18	<0.18
(mg/kg)	Median	1.3	0.74	2.9	0.32	1.1	1.7	<0.18	<0.18	0.24	0.66	<0.18	0.42	0.26	0.52	0.19	<0.18
	Max	1.3	0.93	3.1	0.44	1.3	2.1	<0.18	<0.18	0.27	0.67	<0.18	0.48	0.41	0.58	0.23	<0.18
Riboflavin	Mean	0.66	0.84	1.8	0.60	1.0	0.97	1.7	2.3	2.4	4.5	0.23	0.37	0.42	0.26	1.5	0
(vitamin B2)	Min	0.56	0.79	1.6	0.53	0.94	0.83	1.7	2.3	2.3	4.4	0.17	0.32	0.39	0.20	1.3	<0.1
(mg/kg)	Median	0.70	0.81	1.8	0.61	0.97	0.87	1.7	2.4	2.4	4.6	0.24	0.39	0.41	0.25	1.3	<0.1
	Max	0.71	0.91	1.9	0.64	1.2	1.2	1.8	2.4	2.6	4.6	0.27	0.40	0.46	0.33	1.9	<0.1
Folate	Mean	253	165	35	75	35	377	69	125	67	827	0*	72	59	97	87	0
(vitamin B9)	Min	229	151	<50	73	<50	339	39	112	<50	795		64	54	79	82	<50

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
(µg/kg)	Median	248	154	<50	74	<50	342	84	130	88	819		71	56	105	89	<50
	Max	281	191	54	78	55	451	85	132	89	867		80	66	106	89	<50

1 g/kg = 0.1 g/100 g. No analyses were performed in the food groups subgroup pizza/hand pies, and coffee/tea.

0*, content was assumed to be logical zero and no analyses were performed.

< indicates a value below limit of quantification (LOQ). When calculating means as well as concentrations of vitamin A, D and K, hybrid bound approach was used. This means that medium bound (0.5*LOQ) was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a vitamin below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculation mean.

[1] Concentrations of other carotenoids (lutein, lycopene, zeaxanthin) and tocopherols/tocotrienols (β-, δ-, γ-tocopherol and α-, β-, δ-, γ-tocotrienol) were also analysed. These results are presented in Appendix 5 (section A5.2).

[2] Vitamin A concentrations were expressed as retinol equivalents (RE) and calculated as the sum of (µg trans-all-retinol + β-carotene/6 + (α-carotene + β-cryptoxanthin)/12) (EFSA Panel on Dietetic Products et al., 2015, Blomhoff et al., 2023).

[3] Vitamin D concentrations were determined by vitamin D_3. With exception of plant-based drinks, for which vitamin D_2 concentrations were used (vitamin D_3<3 µg/kg for all three samples with plant-based drinks).

[4] Vitamin K concentrations were calculated as the sum of vitamins K1 and K2.

8.3.2 Exposure estimations and time trend

Estimated mean intakes of vitamin A, D, E, K, thiamin, riboflavin and folate in the Swedish population (per capita intakes) are shown in Table 13. The proportional contribution of each food group to the per capita intakes of fat-soluble and water-soluble vitamins are presented in Figure 9 and Figure 10, respectively. The food group fats and oils was an important contributor to per capita intake for the four fat-soluble vitamins, but vegetables, lean dairy products and meat were also important contributors. Sources for the per capita intake of water-soluble vitamins were more varying, but were in general meat, cereal products, and lean dairy products.

Figure 11 illustrates changes in estimated per capita intake of vitamins in market basket studies. Vitamin D was the only vitamin with more than two observations, and hence an available time trend. For vitamin E, vitamin K and folate, per capita intakes were available for the Market Basket 2015. Vitamin A, thiamin and riboflavin have not been determined in previous market basket studies and were therefore not included in the figure.

Vitamin A

The per capita intake of vitamin A (1400 µg RE/day, Table 13) was almost double the intake in the Riksmaten surveys (660-820 µg/day (Amcoff et al., 2012, Warensjö Lemming et al., 2018b)). Vitamin A in the Swedish Food Composition Database is partly estimated by retinol activity equivalents (1 RAE = 1 µg all-retinol + β-carotene/12 + (α-carotene+β-cryptoxanthin)/24)) instead of retinol equivalents used in the present study (1 RE = µg all-retinol + β-carotene/6 + (α-carotene+β-cryptoxanthin)/12)). This may partly explain the higher intake in the Market Basket 2022, but per capita intake was still higher even if estimated by RAE (1100 µg RAE). Vegetables (40%), fats/oils (22%), and meat (17%) contributed the most to the per capita intake of vitamin A (Figure 9). Vitamin A has not been determined in previous market basket studies.

Vitamin D

The estimated per capita intake of vitamin D (8.2 µg/day, Table 13) was a bit higher than the intake in Riksmaten adults 2010-11 (7.0 µg/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (5.9 µg/day (Warensjö Lemming et al., 2018b)). The major contributors to the per capita intake of vitamin D were fats/oils (43%), lean dairy products (33%) and fatty fish (16%) (Figure 9). Time trend of per capita intake of vitamin D is shown in Figure 11. The per capita intake of vitamin D increased with approximately 30% since it was first measured in 2010 (6.1 µg/day (Swedish Food Agency, 2012)) and with 17% from 2015 (7.0 µg/day (Swedish Food Agency, 2017)). The increase from the Market Basket 2015 was mainly driven by a higher vitamin D content in lean dairy products (from 0.3 µg/100 g to 1.1 µg/100 g) and is explained by the implementation of the new fortification policy in 2018 (Swedish Food Agency, 2018, Itkonen et al., 2021). This legislation meant that milk ≤ 1.5% fat, margarine, and fat blends were fortified at higher levels and that more products (all milk, yoghurt and sour milk products with fat <3%, lactose-free products, vegetable-based alternatives and fat blends) were fortified. The increase before 2015 was mainly driven by higher concentrations in the food group fats and oils and could be due to that some manufacturer started with fortification of fats prior the new legislation was entered into force. Interestingly, the per capita intake of vitamin D from dairy products increased despite that the consumption of dairy products decreased during the same period.

Vitamin E

The per capita intake of vitamin E (α-tocopherol) was 22 mg/day (Table 13). This was almost twice as high as the intakes in the Riksmaten surveys (12 mg/day (Amcoff et al., 2012, Warensjö Lemming et al., 2018b)). Fats/oils (34%) was the main contributor to the intake of vitamin E, followed by cereal products (9%), fruits (9%), and pastries (8%) (Figure 9). Vitamin E was about 24% higher in the Market Basket 2022 compared to in 2015 (22 mg/day vs 17 mg/day). The higher per capita intake in 2022 did not seem to be attributed to a specific food group but was rather general over all food groups.

Vitamin K

Estimated per capita intake of vitamin K was 160 µg/day (Table 13). No comparisons were made with the Riksmaten surveys. These surveys do not include vitamin K intake because it is not fully covered in the Swedish Food Composition Database. The per capita intake was similar as estimated in the previous market basket study in 2015 (approximately 180 µg/day (Swedish Food Agency, 2017)). There were no major differences in vitamin K content of the food groups between the studies. The only exceptions were a reduction of vitamin K content in the food group sugar/sweets (from 7 to 2 µg/100 g) and increased content in the food group fats/oils (from 47 to 56 µg/100 g), which was explained by that fatty dressings was included in sugar/sweets in the Market Basket 2015 and fats/oils in the Market Basket 2022. Vegetables (38%), fats/oils (20%), and meat (19%) comprised most of the per capita intake of vitamin K (Figure 9).

Thiamin (vitamin B1)

The per capita intake of thiamin (1.2 mg/day, Table 13), which was equal to the intakes estimated in Riksmaten adults 2010-11 (12 mg/day (Amcoff et al., 2012)), and Riksmaten adolescents 2016-17 (13 mg/day (Warensjö Lemming et al., 2018b)). The main contributors to the per capita intake of thiamin were meat (47%), cereal products (24%), and vegetables (9%) (Figure 10). Thiamin has not been determined in previous market basket studies.

Riboflavin (vitamin B2)

The per capita intake of riboflavin was 1.7 mg/day (Table 13), which was in line with the intakes observed in Riksmaten adults 2010-11 (1.5 mg/day (Amcoff et al., 2012)), and Riksmaten adolescents 2016-17 (1.6 mg/day (Warensjö Lemming et al., 2018b)). Lean dairy products (26%), meat (20%), and fatty dairy products (10%) contributed the most to the per capita intake of riboflavin (Figure 10). Riboflavin has not been determined in previous market basket studies.

Folate (vitamin B9)

The estimated per capita intake of folate (180 µg/day, Table 13) was lower than the intakes of 260 µg/day in the Rikmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). The per capita intake was similar as estimated in the previous market basket study in 2015 (205 µg/day), especially considering lower and upper bound estimations (173-194 µg/day). The intake in the Market Basket 2015 has been corrected due to an error in the calculation. The main contributor to the per capita intake of folate was cereal products (32%), followed by eggs (14%), vegetables (10%), and lean dairy products (10%) (Figure 10).

Table 13. Mean daily intake of vitamins from food groups and total intake in the Market Basket 2022 (N=3 samples per food group).

Food group	Per capita consumption (g/person/day)		Per capita intake (per person/day) Vit A (µg)	Vit D (µg)	Vit E (mg)	Vit K (µg)	Thiamin (mg)	Riboflavin (mg)	Folate (µg)
		LB	0	0		4.3			
Cereal products	226	HB	0	0	2.0	4.3	0.29	0.15	57
		UB	17	0.68		6.5			
		LB	12	0		3.4			
Pastries	55	HB	13	0	1.7	3.4	0.04	0.05	9.1
		UB	13	0.17		4.0			
		LB		0					3.5
Meat	194	HB	237	0	1.5	30	0.56	0.34	6.7
		UB		0.58					9.9
		LB	0			0.07			
Lean fish	15	HB	0	0.07	0.27	0.12	0.01	0.01	1.1
		UB	0.90			0.32			
		LB							0.33
Fatty fish	18	HB	1.5	1.3	0.72	1.0	0.02	0.02	0.63
		UB							0.93
		LB	0.11	0		0.26			
Meat substitutes	3	HB	0.11	0	0.06	0.26	0.01	0	1.1
		UB	0.31	0.01		0.29			
		LB	46			0	0		
Lean dairy products	248	HB	46	2.7	0.16	0	0	0.43	17
		UB	48			5.0	0.04		
		LB		0			0		
Fatty dairy products	70	HB	173	0	0.44	7.2	0	0.16	8.7
		UB		0.21			0.01		
		LB	0.06	0.13		0.52			0.77
Plant-based drinks	13	HB	0.10	0.13	0.11	0.52	0	0.03	0.87
		UB	1.0	0.17		0.65			0.98
		LB				6.4			
Eggs	29	HB	17	0.40	1.5	6.4	0.02	0.13	24
		UB				6.7			

Food group	Per capita consumption (g/person/day)		Per capita intake (per person/day)						
			Vit A (µg)	Vit D (µg)	Vit E (mg)	Vit K (µg)	Thiamin (mg)	Riboflavin (mg)	Folate (µg)
		LB					0		
Fats and oils	55	HB	296	3.5	7.4	31	0	0.01	0*
		UB					0.01		
		LB	546			60			
Vegetables	245	HB	546	0*	1.4	60	0.10	0.09	18
		UB	560			62			
		LB	33			8.4			
Fruits	215	HB	33	0*	1.8	8.4	0.06	0.09	13
		UB	46			11			
		LB	0			3.2			
Potatoes	142	HB	0	0*	0.53	3.2	0.07	0.04	14
		UB	11			4.7			
		LB		0		1.4			
Sugar and sweets	74	HB	14	0	0.75	1.4	0.01	0.11	6.4
		UB		0.22		2.2			
		LB	0				0	0	0
Beverages	262	HB	0	0*	1.1	0*	0	0	0
		UB	16				0.05	0.03	13.1
		LB	**1375**	**8.2**		**157**	**1.2**		**173**
Total		**HB**	**1375**	**8.2**	**22**	**157**	**1.2**	**1.7**	**177**
		UB	**1453**	**10**		**172**	**1.3**		**194**
Average requirement[1]			540/630	7.5	8/9	50/60	0.65/0.75	1.3	250
Riksmaten adults[2]			821	7.0	12		1.2	1.5	259
Riksmaten adolescents[3]			657	5.9	12		1.3	1.6	263

Macronutrients were not analysed in pizza/hand pies and coffee/tea. 0*, content was assumed to be logical zero and no analyses were performed.
LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of quantification (LOQ) is used for non-detects, except for when all three samples in one food group have concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOQ is used for non-detects).

[1] Average requirement according to the Nordic Nutrition Recommendations 2023 for females/males 25-70 years (Blomhoff et al., 2023).
[2] Riksmaten adults 2010-11 (Amcoff et al., 2012).
[3] Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

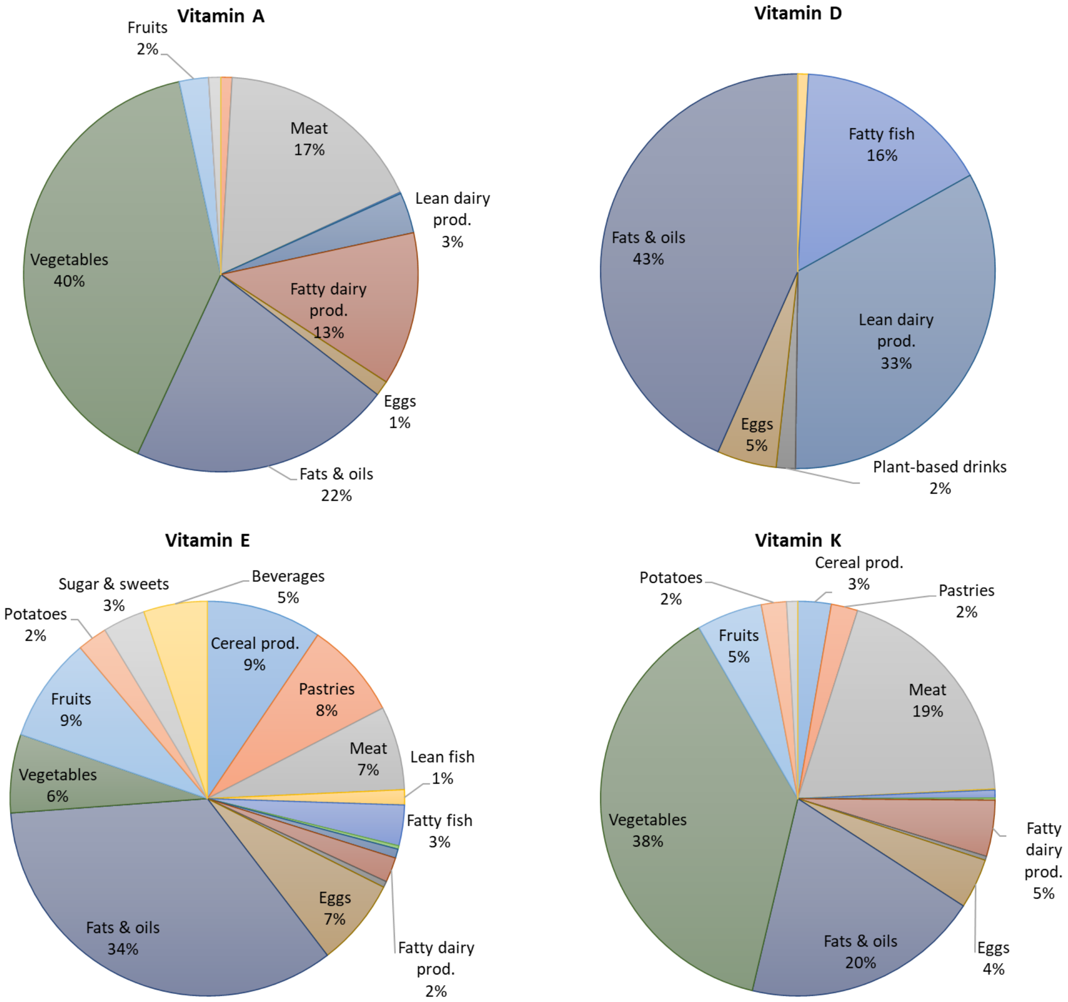

Figure 9. Percentage contribution to the per capita intake of fat-soluble vitamins (A, D, E, K) from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a vitamin below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

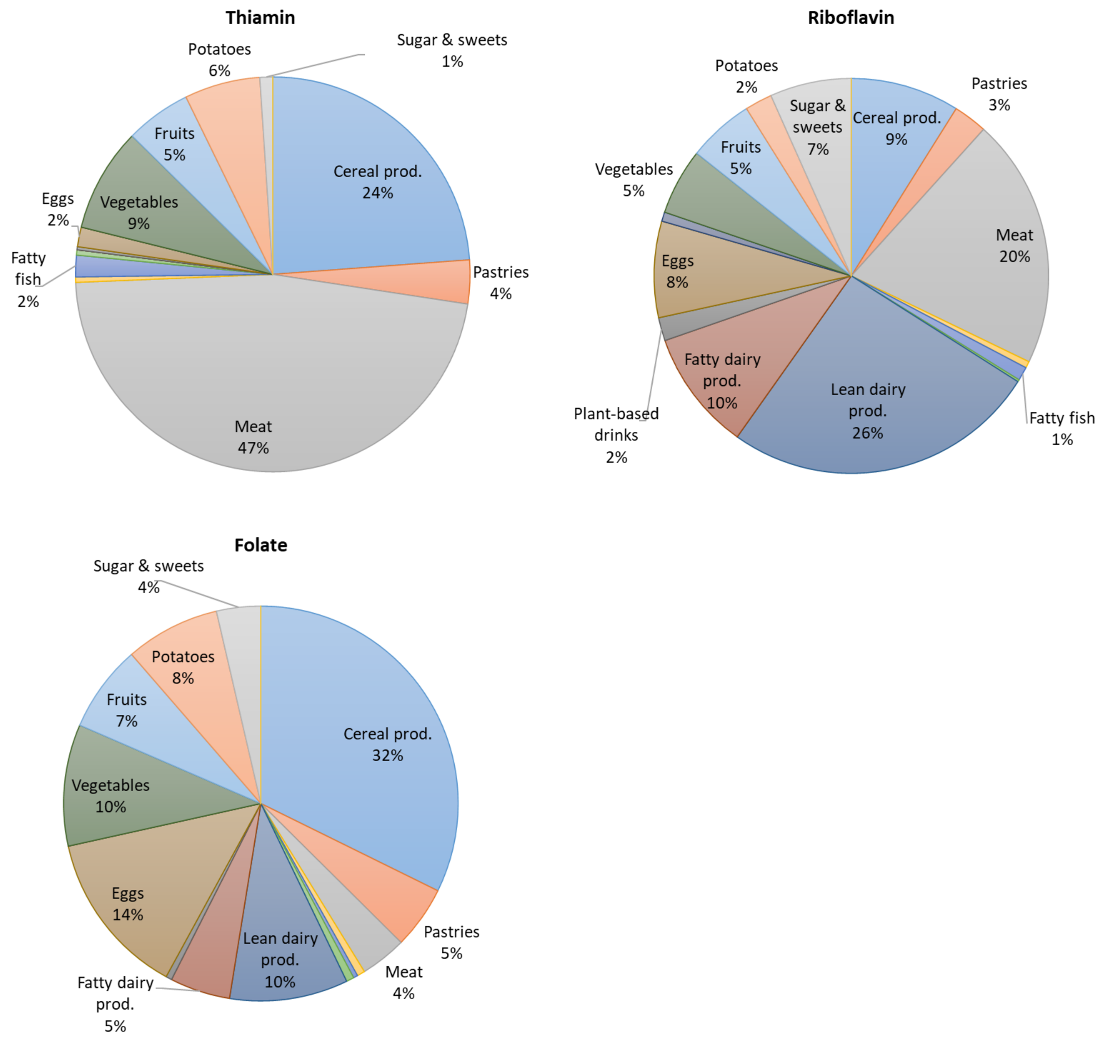

Figure 10. Percentage contribution to the per capita intake of water-soluble vitamins (thiamin, riboflavin, folate) from different food groups in the Market Basket 2022.
Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a vitamin below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

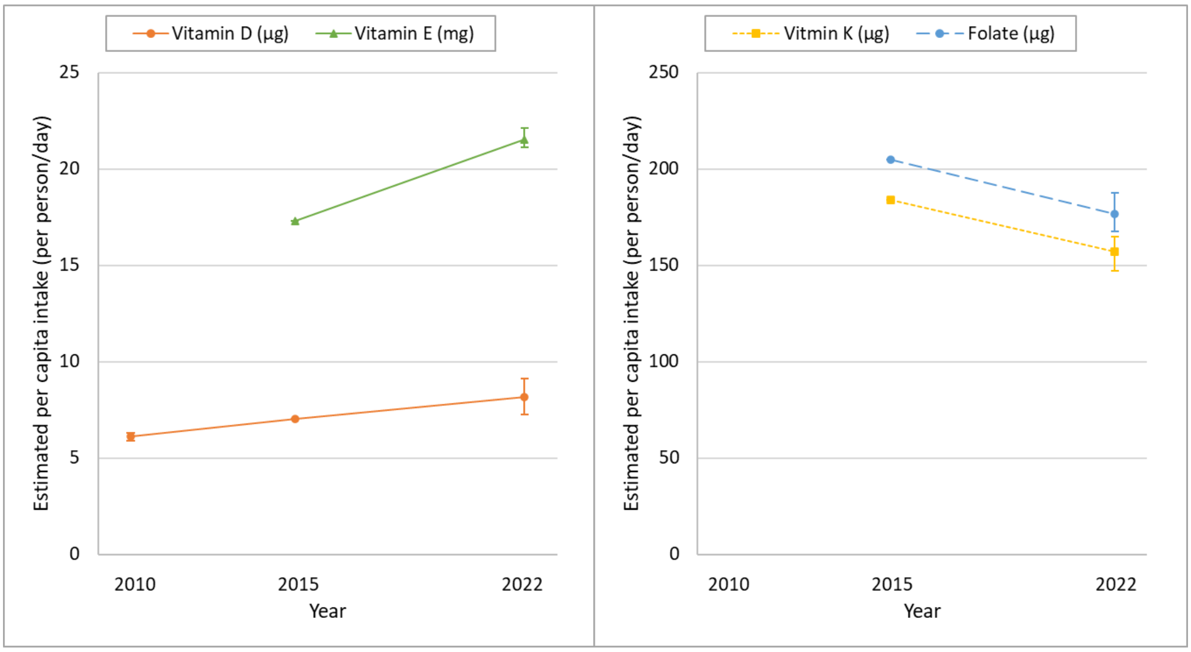

Figure 11. Estimated per capita intake of vitamins in market basket studies over time.
Note, that the per capita intake is a function of per capita consumption and compound concentrations in the food groups. Intake from coffee and tea is not included. Vertical lines indicate minimum and maximum values. Number of samples per food group was: N=2 (2010), N=1 (2015), N=3 (2022). Vitamin E, vitamin K, and folate has previously been determined in 2015 only. Vitamin A, thiamin and riboflavin has not been analysed in market basket studies before 2022 and are not included in the figure.

8.3.3 Risk and benefit assessments

Assessments of benefits or risks with the per capita intakes of vitamins in the Market Basket 2022 was mainly evaluated using AR and upper levels (UL) for adults 25-50 years as defined in the NNR (Blomhoff et al., 2023). Provisional AR was used if no AR was established. Per capita intakes were also compared with RI or adequate intakes (AI) for adults 25-50 years as defined in NNR (Blomhoff et al., 2023).

Figure 12 shows the per capita intakes of vitamins in relation to AR or provisional AR. Value below one indicates insufficient intake at population level. The estimated per capita intakes of most vitamins were above AR, indicating adequate intakes at population level. However, there seemed to be a small margin for vitamin D, and the intake of folate was below AR.

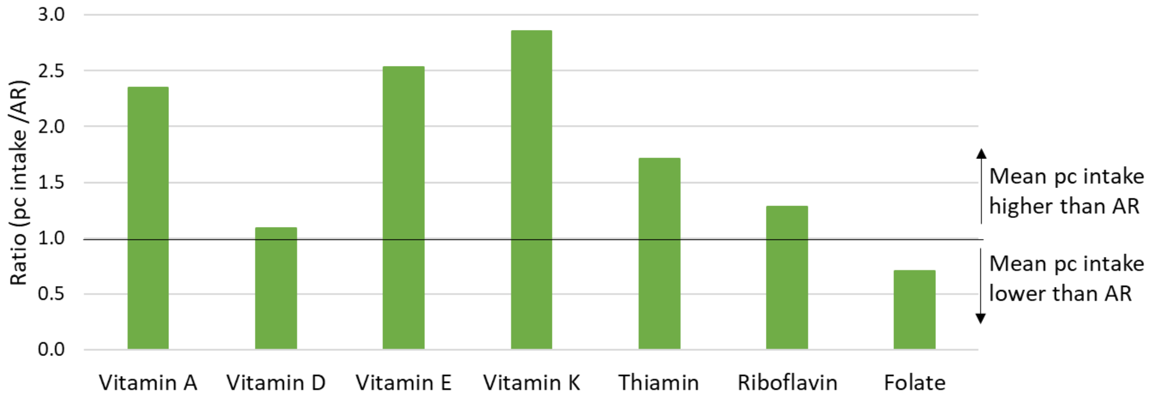

Figure 12. Estimated per capita (pc) intakes of vitamins in the Market Basket 2022 in relation to average requirement (AR) or provisional AR.
Recommendations for adults 25-50 years are used (Blomhoff et al., 2023). Mean AR was used if AR was different for men and women.

Vitamin A

Vitamin A is important for the nighttime vision and in the systemic maintenance of growth and integrity of cells in body tissues (Blomhoff et al., 2023). The per capita intake of 1400 RE/day was far above both AR (540 RE/day for women and 630 RE/day for men) and RI (700 RE/day for women and 800 RE/day for men). AR was also reached in the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). There was a margin to the UL of 3000 RE/day (Blomhoff et al., 2023).

Vitamin D

Vitamin D has an important role in calcium and phosphorus metabolism and in the maintenance of a healthy skeleton. It is also associated with lower total mortality and cancer mortality. The estimated per capita intake (8.2 µg/day, Table 13) was in line with AR (7.5 µg/day) but below RI (10 µg/day) (Blomhoff et al., 2023). In Riksmaten adults 2010-11 (Amcoff et al., 2012), mean intake of vitamin D for men was in line with AR whereas the intake for women was below the recommendation. Intake was also below AR in Swedish adolescents (Warensjö Lemming et al., 2018b). Both these surveys were however conducted before the fortification policy in 2018 (Swedish Food Agency, 2018, Itkonen et al., 2021). Vitamin D is also produced in the skin during sun exposure, complicating the assessment of an adequate vitamin D status in the population. Even though few adults had plasma/serum 25-hydroxyvitamin D concentrations below 30 nmol/L, indicating deficiency (Nälsén et al., 2020), concentrations vary depending on several factors such as season, country of birth, age (Nälsén et al., 2020, Warensjö Lemming et al., 2022). The per capita intake was below UL of 100 µg/day (Blomhoff et al., 2023).

Vitamin E

Vitamin E (α-tocopherol) is an antioxidant and prevents oxidative damage of molecules such as DNA or lipids. Provisional AR is set to 8 and 9 α-TE/day for women and men, respectively. AI is set to 10 and 11 α-TE/day for women and men, respectively (Blomhoff et al., 2023). The estimated per capita intake of vitamin E (22 mg/day, Table 13) was far above both the provisional AR and the AI. This is in line with results from the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). The per capita intake was below the UL of 300 mg/day (Blomhoff et al., 2023).

Vitamin K

Vitamin K is an essential factor for vitamin K dependent proteins involved in functions such as coagulation, bone health and vascular calcification (Blomhoff et al., 2023). The per capita intake of vitamin K (160 µg/day, Table 13) was far above both the provisional AR (50 µg/day for women and 60 µg/day for men) and the AI (65 µg/day for women and 75 µg/day for men) (Blomhoff et al., 2023). There is no set UL for vitamin K (Blomhoff et al., 2023).

Thiamin (vitamin B1)

Thiamin is a coenzyme in the metabolism of carbohydrates and branched-chain amino acids (EFSA Panel on Dietetic Products et al., 2016). The estimated per capita intake of 1.2 mg/day (Table 13) was above the AR (0.65 mg/day for women and 0.75 for men). It was also slightly higher than the RI of 0.9 mg/day for women and 1.1 mg/day for men (Blomhoff et al., 2023). This is in agreement with results from the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). There is no UL for thiamin (Blomhoff et al., 2023).

Riboflavin (vitamin B2)

Riboflavin functions as cofactors of flavoprotein enzymes involved in several redox reactions in the energy metabolism (Blomhoff et al., 2023). The estimated per capita intake (1.7 mg/day, Table 13) was above both the AR (1.3 mg/day) and RI (1.6 mg/day). An adequate intake of riboflavin agrees with the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). There is no UL for riboflavin (Blomhoff et al., 2023).

Folate (vitamin B9)

Folate is an essential cofactor for enzymes involved in the biosynthesis of nucleotides (RNA and DNA). Folate intake prevents against folate-deficient anaemia and reduce the risk of neural tube defects in infants (Blomhoff et al., 2023). The estimated per capita intake (180 µg/day, Table 13) was below the AR of 250 µg/day (Blomhoff et al., 2023). However, assessment of folate intake is, in addition to traditional limitations, also complicated by challenges in quantification of folate concentrations in foods. Analytical methods may differ up to 30% (Öhrvik et al., 2018). Folate is also sensitive to light and oxidation and is partly degraded by cooking (Blomhoff et al., 2023). Therefore, folate intake often is complemented with blood folate as a biomarker for status. Biomonitoring in Riksmaten adults 2010-11 showed that the prevalences of low erythrocyte and plasma folate concentrations were low in Swedish adults, not considering requirement during pregnancy (Öhrvik et al., 2018). The UL is set for synthetic folic acid (7 mg/day) (Blomhoff et al., 2023). Hence, the UL is far above the estimated folate intake.

8.3.4Conclusion

The estimated population average supplies of vitamin A, D, E (α-tocopherol), K, thiamin (vitamin B1), riboflavin (vitamin B2) and folate (vitamin B9) were determined in the Market Basket 2022. Most of the vitamins were far above their AR with a marginal (Figure 12). This could strengthen the accuracy of the conclusion of an adequate intake at populational level, considering that the market basket studies do not adjust for food waste, and thereby overestimate the per capita intake. Hence, for vitamin A, E, K, thiamin and riboflavin, a sufficient intake in the Swedish population is indicated.

For vitamin D, there was a smaller margin between the per capita intake and AR. This could imply that the intake is adequate in the general Swedish population but that there are groups at risk of deficiency. This is in line with other studies (Warensjö Lemming et al., 2022, Nälsén et al., 2020). The higher vitamin D fortification of fluid dairy products implemented in 2018 (Swedish Food Agency, 2018, Itkonen et al., 2021) have led to a higher per capita intake of vitamin D from this food group despite decreased consumption.

The estimated per capita intake of folate was below the AR, which could indicate a suboptimal intake in the general population. However, there are analytical methodological challenges with quantification of folate content in foods limiting interpretations of an adequate folate intake. Therefore, intake estimations often are complemented with status assessed by plasma or serum folate concentrations. A previous study has shown a low prevalence of folate deficiency in the Swedish adult population, but that it is difficult for fertile women to obtain optimal folate status to reduce risk of neural tube defects via food only, without folic acid supplements (Öhrvik et al., 2018).

8.4 Minerals

Five essential macro elements and nine essential trace elements were analysed in the Market Basket 2022. The macro elements were calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), and phosphorus (P). The essential trace elements were cobalt (Co, essential as a component of vitamin B12), chromium (Cr), cupper (Cu), iron (Fe), iodine (I), manganese (Mn), molybdenum (Mo), selenium (Se), and zinc (Zn)). ALS Scandinavia performed the chemical analyses (except for iodine) using High Resolution Inductively Coupled Plasma Mass Spectrometry (HC-ICP-MS). Iodine concentrations were analysed by SGS Analytics using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The chemical analyses are described in Appendix 4 (section A4.3). LODs are shown in Table 14. LOQ is calculated by multiplying LOD with 3.3.

Table 14. Limits of detection for analyses of minerals in the Market Basket 2022.

Type of sample	Limits of detection (µg/kg)					
	Ca	Co	Cr	Cu	Fe	I[1]	K
Solid	696	0.24	2.2	4.3	66	10	2567
Liquid	200	0.20	2	5	50	10	100
	Mg	Mn	Mo	Na	P	Se	Zn
Solid	43	2.6	0.01	1620	172	8.3	72
Liquid	50	5	1	200	100	5	20

1 µg/kg = 0.001 mg/kg = 0.1 µg/100 g = 0.0001 mg/100

[1] Limit of quantification (LOQ)

8.4.1 Concentrations in food groups

Concentrations of minerals in the different food groups in the Market Basket 2022 are presented in Table 15. According to the EU regulation for nutrient claims (Regulation (EC) No 1924/2006), significant amount of minerals corresponds to 15% of the nutrient reference values according to EU regulation 1169/2011 (Regulation (EU) No 1169/2011). The purpose of the regulation is to harmonise the provisions for nutrition and health claims for commercial communication of individual products. An evaluation of the nutrient content of the food groups in the Market Basket 2022 was done using the EU regulation 1169/2011 (Regulation (EU) No 1169/2011). It should however only be considered as an indication and individual food items can still have significant amounts of minerals although the food group has a content below the requirement.

Calcium (Ca)

Fatty and lean dairy products, and pizza/hand pie had the highest calcium concentrations (Table 15). The calcium contents of these food groups fulfilled the criterion for significant amount, i.e. corresponded to more than 15% of the nutrient reference value (800 mg/100 g) (Regulation (EU) No 1169/2011).

Cobalt (Co)

The highest cobalt concentrations were found in sugar/sweets, meat substitutes, and pastries (Table 15). EU has not set any nutrient reference value for cobalt.

Chromium (Cr)

Cereal products, pastries, pizza/hand pie, meat, meat substitutes, vegetables, and sugar/sweets had a chromium content corresponding to more than 15% of the nutrient reference value (40 µg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011). The highest chromium concentrations were found in sugar/sweets, pastries, and meat substitutes (Table 15).

Copper (Cu)

Meat substitutes, cereal products, and sugar/sweets had the highest copper concentrations (Table 15). The levels corresponded to more than 15% of the nutrient reference value (1 mg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Iron (Fe)

The highest iron concentrations were found in meat substitutes, eggs, and cereal products (Table 15). Meat substitutes was the only food group fulfilling the criterion for significant amount, i.e. with an iron content corresponding to more than 15% of the nutrient reference value (14 mg/100 g) (Regulation (EU) No 1169/2011). Iron oxide is used in some meat substitute products for the red colouring. However, the chemical analysis method does not differentiate between diverse forms of iron with varying bioavailability. The bioavailability of iron from food is highly variable, and type of iron in food must be considered. Haem iron found in meat, fish, and seafood are more easily absorbed than non-haem iron. The iron absorption from foods is generally around 10-15% but may vary between less than 2% to 50% depending on individual iron status, type of iron consumed and simultaneous intake of other food components (Domellöf and Sjöberg, 2024). The concentration of iron in meat substitutes has only limited impact on the per capita intake because of the low mean intake of meat substitutes in the population.

Iodine (I)

Lean fish, and eggs had the highest concentrations of iodine (Table 15). The content in these food groups corresponded to more than 15% of the nutrient reference value (150 µg/100 g) and fulfilled the criterion for significant amount (Regulation (EU) No 1169/2011).

Potassium (K)

Meat, processed meat, fatty fish, meat substitutes, and potatoes had a potassium content corresponding to the criterion for significant amount, i.e. more than 15% of the nutrient reference value (2000 mg/100 g) (Regulation (EU) No 1169/2011). The highest potassium concentrations were found in potatoes, meat substitutes, and meat (Table 15).

Magnesium (Mg)

Meat substitutes, cereal products, and sugar/sweets had the highest concentrations of magnesium (Table 15). Meat substitutes was the only food group with a magnesium content corresponding to more than 15% of the nutrient reference value (375 mg/100 g), i.e. fulfilling the criterion for significant amount (Regulation (EU) No 1169/2011).

Manganese (Mn)

Cereal products, pastries, pizza/hand pie, meat substitutes, fruits, and sugar/sweets had a manganese content corresponding to the criterion for significant amount, i.e. more than 15% of the nutrient reference value (2 mg/100 g) (Regulation (EU) No 1169/2011). The highest magnesium concentrations were found in cereal products, and meat substitutes (Table 15).

Molybdenum (Mo)

Cereals, pastries, pizza/hand pie, meat substitutes, and plant-based drinks had a molybdenum content corresponding to more than 15% of the nutrient reference value (50 µg/100 g) and the criterion for significant amount (Regulation (EU) No 1169/2011). The highest concentrations of molybdenum were observed in meat substitutes, and cereal products (Table 15).

Sodium (Na)

The highest sodium concentrations were found in processed meat (640 mg/100 g corresponding to 1.6 g salt), followed by fatty fish (400 mg/100 g corresponding to 1.0 g salt) (Table 15). A health claim of low sodium content may be used on a product if the product contains maximum 0.12 g sodium per 100 g (Regulation (EC) No 1924/2006). The following food groups had sodium concentrations below 0.12 g per 100 g; lean dairy products, plant-based drinks, fruits, vegetables, potatoes, sugar/sweets, beverages, and coffee/tea. The 80%

reduction of sodium concentrations in sugar/sweets compared with the Market Basket 2015 was due to exclusion of ketchup (2022 included in vegetables), mustard (excluded), and fatty dressings (2022 included in fats/oils), see Table 3. The reduction in pastries by 24% was probably partly due to the lower proportion of pizza and hand pies (Table 3). However, a reduction of sodium was also seen in the subgroup pizza/hand pies compared with the Market Basket 2015 (3.7 g/kg and 4.6 g/kg, respectively) (Swedish Food Agency, 2017). Therefore, there also seems to be a true sodium reduction in these products.

Phosphorus (P)

Many food groups had a phosphorus content corresponding to more than 15% of the nutrient reference value (700 mg/100 g), i.e. criterion for significant amount (Regulation (EU) No 1169/2011): cereals, pastries, pizza/hand pie, meat, processed meat, lean and fatty fish, meat substitutes, lean and fatty dairy products, plant-based drinks, eggs, and sugar/sweets. The highest phosphorus concentration was obtained in fatty dairy products (Table 15).

Selenium (Se)

Meat, processed meat, lean and fatty fish, fatty dairy products, and eggs had a selenium content corresponding to the criterion for significant amount, i.e. more than 15% of the nutrient reference value (55 µg/100 g) (Regulation (EU) No 1169/2011). The highest concentrations were measured in lean fish, eggs, and fatty fish (Table 15).

Zinc (Zn)

Cereals, pizza/hand pie, meat, processed meat, fatty dairy products, and eggs had a zinc content corresponding to the criterion for significant amount, i.e. more than 15% of the nutrient reference value (10 mg/100 g) (Regulation (EU) No 1169/2011). The highest concentrations of zinc were detected in fatty dairy products, and meat (Table 15).

Table 15. Concentrations of minerals in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	*Pizza, hand pie*	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea
Ca (mg/kg)	Mean	537	646	1459	110	101	220	142	956	1453	6429	1003	601	112	247	206	65	823	32	52
	Min	393	416	1288	97	74	192	108	850	1331	6163	943	596	101	229	187	50	627	31	51
	Median	508	657	1420	109	89	198	112	987	1512	6480	1027	602	107	252	196	67	810	32	51
	Max	711	866	1669	123	141	270	206	1031	1517	6643	1039	605	128	262	236	79	1032	33	53
Co (µg/kg)	Mean	13	19	10	1.9	1.5	3.5	4.5	21	0.52	1.3	4.4	1.3	0.76	6.7	4.9	7.8	56	0.34	2.7
	Min	10	16	9.1	1.2	1.3	3.4	4.4	21	0.38	1.2	2.0	1.1	0.40	5.1	4.4	5.1	52	<0.20	2.3
	Median	10	20	10	1.7	1.5	3.4	4.5	21	0.49	1.2	5.3	1.3	0.76	5.4	4.9	7.7	53	0.35	2.8
	Max	19	23	10	2.9	1.7	3.5	4.6	21	0.70	1.6	5.9	1.6	1.1	10	5.3	11	63	0.57	2.9
Cr (µg/kg)	Mean	81	190	92	85	35	34	18	115	0	7.9	22	0	11	70	27	47	287	10	0
	Min	64	177	74	23	24	20	8.5	105	<2.2	5.3	19	<2.2	6.2	18	19	32	263	<2.0	<2.0
	Median	83	196	98	29	33	34	14	108	<2.2	8.6	21	<2.2	10	82	23	33	269	<2.0	<2.0
	Max	96	196	105	204	46	48	32	132	<2.2	10	25	<2.2	16	111	39	75	327	28	<2.0
Cu (µg/kg)	Mean	2528	1475	1116	646	643	827	545	2610	102	320	601	710	65	581	1090	966	2070	18	23
	Min	2368	1244	1102	615	606	664	517	2404	50	317	488	691	50	499	970	764	1735	16	22
	Median	2395	1537	1104	615	642	800	546	2555	64	319	621	716	58	563	1041	1056	1919	18	23
	Max	2821	1646	1141	707	681	1016	574	2870	192	323	695	723	86	682	1260	1077	2557	20	26
Fe (mg/kg)	Mean	14	11	8.7	11	11	2.6	3.2	26	0.28	0.89	2.5	18	1.1	4.0	3.1	4.4	13	0.13	0.10
	Min	13	10	8.2	11	10	2.1	3.1	24	0.18	0.87	1.8	17	1.0	3.2	2.8	4.3	12	<0.05	0.10
	Median	14	12	8.6	11	11	2.9	3.3	25	0.28	0.90	2.6	18	1.1	4.0	3.0	4.4	12	0.05	0.10
	Max	14	13	9.4	11	11	2.9	3.4	30	0.37	0.91	3.0	20	1.2	4.8	3.5	4.5	15	0.30	0.10
I (µg/kg)	Mean	57	49	48	142	38	697	173	90	147	177	130	447	36	27	41	16	157	34	15
	Min	54	43	40	82	28	500	130	62	140	160	120	340	32	20	15	10	120	15	12
	Median	56	47	41	95	32	760	170	99	140	170	120	500	35	21	37	13	120	28	13
	Max	61	57	64	250	53	830	220	110	160	200	150	500	40	40	70	26	230	58	21
K (mg/kg)	Mean	2694	2183	2596	3708	3345	2542	3542	4240	1910	946	1951	1579	440	2520	2425	4372	2805	127	980
	Min	2584	1865	2535	3311	2507	2166	3527	4122	1797	926	1252	1530	413	2418	2344	3877	2408	104	914
	Median	2737	2236	2580	3790	2882	2543	3546	4139	1964	951	2151	1595	453	2488	2357	4155	2816	118	956
	Max	2760	2448	2672	4022	4647	2915	3554	4459	1968	961	2450	1611	453	2653	2575	5085	3191	158	1070
Mg (mg/kg)	Mean	473	271	249	226	150	257	290	716	134	257	79	146	20	134	226	252	333	13	57
	Min	456	235	240	212	144	248	262	686	127	248	62	140	19	131	225	224	314	12	57

		Cereal products	Pastries	*Pizza, hand pie*	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea
	Median	464	286	246	232	148	251	301	688	136	259	79	147	19	133	227	260	325	13	57
	Max	499	291	260	235	158	272	307	774	138	264	97	152	22	139	227	271	359	14	57
Mn (µg/kg)	Mean	10807	5269	3547	390	671	319	256	10338	40	135	1275	604	98	1614	3209	1332	3614	26	923
	Min	10311	4440	3176	267	222	274	160	9203	35	126	954	577	74	1496	2897	1138	3033	20	752
	Median	10912	5328	3413	391	624	322	263	9724	41	133	1086	592	104	1619	3078	1302	3392	22	867
	Max	11200	6038	4053	511	1166	362	345	12086	43	144	1784	643	117	1728	3652	1555	4417	35	1150
Mo (µg/kg)	Mean	356	160	135	38	36	14	7.6	531	47	59	140	32	13	63	63	68	69	2.4	1.2
	Min	344	151	133	30	36	12	5.8	433	40	57	93	30	12	52	56	52	68	1.8	1.1
	Median	351	159	135	33	37	13	7.2	565	49	59	113	32	13	67	63	75	68	2.6	1.2
	Max	372	171	137	50	37	16	10	595	52	62	214	34	14	69	70	77	71	2.8	1.2
Na (mg/kg)	Mean	2334	2817	3710	3263	6423	3204	4029	3287	325	3593	363	1265	3179	903	189	320	565	52	18
	Min	2108	2770	3592	2672	6015	2669	3623	2985	315	3232	349	1172	3010	861	183	222	306	44	16
	Median	2347	2793	3763	3518	6495	3269	4011	3350	328	3497	363	1264	3166	913	185	306	555	50	18
	Max	2546	2888	3776	3598	6760	3675	4455	3526	331	4049	377	1357	3361	935	200	432	833	62	19
P (mg/kg)	Mean	2262	1552	2236	2428	1935	2010	2666	2590	1409	5257	1136	2801	238	408	433	694	1259	80	43
	Min	2110	1411	1937	2303	1838	1880	2499	2561	1280	5213	813	2744	237	397	414	539	1100	72	43
	Median	2315	1595	2344	2444	1969	2060	2654	2586	1439	5273	1166	2814	237	411	424	765	1222	80	44
	Max	2361	1649	2428	2537	1999	2090	2844	2623	1506	5285	1429	2843	239	416	462	778	1454	88	44
Se (µg/kg)	Mean	43	23	43	125	139	269	173	63	18	111	0	243	10	0	5.7	0	16	0	0
	Min	32	20	37	115	124	258	156	59	12	104	<8.3	218	9.4	<8.3	<8.3	<8.3	15	<5.0	<5.0
	Median	46	22	42	122	142	270	179	59	20	111	<8.3	244	10	<8.3	<8.3	<8.3	16	<5.0	<5.0
	Max	51	26	48	138	151	280	184	70	22	117	<8.3	265	12	<8.3	8.9	<8.3	18	<5.0	<5.0
Zn (mg/kg)	Mean	15	8.5	16	22	16	5.6	4.6	13	4.4	27	1.6	15	0.93	2.7	2.4	3.0	5.6	0.01	0.08
	Min	14	6.8	15	21	15	5.4	4.2	10	3.6	27	1.0	14	0.90	2.5	2.2	2.8	5.3	<0.02	0.07
	Median	15	9.0	16	23	16	5.6	4.6	11	4.6	28	1.5	14	0.92	2.7	2.4	2.9	5.4	<0.02	0.08
	Max	16	10	16	24	17	5.9	5.0	18	4.9	28	2.3	15	1.0	2.8	2.5	3.4	6.0	0.02	0.08

< indicates a value below limit of detection (LOD). When calculating mean, hybrid bound approach was used. This means that medium bound concentration (0.5*LOD) was imputed for non-detects, with exception for when all three samples in one food group had concentrations of an element below LOD. In those cases, lower bound (0) was imputed for non-detects when calculation mean.

8.4.2 Exposure estimations and time trends

Estimated mean intakes of the minerals in the Swedish population (per capita intakes) are shown in Table 16. The proportional contribution of each food group to the per capita intakes are presented in Figure 13, Figure 14, and Figure 15. The food group cereal products was an important contributor to per capita intake for most of the analysed minerals. The food group cereal products was one of the three major sources for all minerals, except for potassium and iodine, for which it was the fourth major source. Other important food groups for intakes of many minerals were dairy products, vegetables, and fruits.

Figure 16 illustrates changes in estimated per capita intake of minerals in market basket studies since 1999. Per capita intakes in 1999, 2005, and 2010 were estimated by pooled samples analysed in year 2017. Concentrations were analysed in one pooled sample per food group and market basket study. It is possible that loss of water content and other factors have affected the analysed concentrations of these samples, which must be kept in mind when interpreting these time trends. The results from the analyses conducted in 2017 were compared with the analytical results from 1999 and 2010 to see the agreement, which was considered when interpreting the results. No statistical testing of time trends was done due to the low number of observations. For most minerals, no clear time trends were observed, and the change from 1999 was mostly less than 25%. The estimated intake of manganese had increased with almost 50% since 1999. Decreasing time trend was seen for estimated per capita intake of sodium. There was also a small decrease of per capita intake of iron since 2005, but not 1999.

Calcium (Ca)

The per capita intake of calcium (1200 mg/day, Table 16) was higher than in Riksmaten adults 2010-11 (880 mg/day (Amcoff et al., 2012)), whereas it was more in line with results from Riksmaten adolescents 2016-17 (1100 mg/day (Warensjö Lemming et al., 2018b)). Fatty dairy (36%), lean dairy (29%), and cereal (10%) products contributed most to the per capita intake of calcium (Figure 13). There were no changes over time in per capita intake of calcium (Figure 16).

Cobalt (Co)

The per capita intake of cobalt was 14 µg/day. The per capita intake was slightly higher in the Market Basket 2022 compared with 2015 (11 µg/day), which may be explained by inclusion of coffee and tea in the study 2022 (Table 16). No time trend was observed when excluding coffee and tea (Figure 16). The main contributors to the per capita intake of cobalt were sugar/sweets (30%), cereal products (20%), and vegetables (12%) (Figure 13). Intake of cobalt was not determined in the Riksmaten surveys.

Chromium (Cr)

The estimated per capita intake in the population was approximately 100 µg/day (Table 16). This was higher than previously estimated by EFSA (57-84 µg/day (Blomhoff et al., 2023)). Intake of chromium was not determined in the Riksmaten surveys. The per capita intake of chromium was more than doubled in the Market Basket 2022 compared with 2015 (41 µg/day (Swedish Food Agency, 2017)). However, the time trend when including data from all previous market basket studies were fluctuating and no consistent trend was seen (Figure 16). Also, data from the market basket studies between 1999 and 2010 are difficult to interpret because the concentrations of pooled samples from analyses conducted in 2017 were higher than concentrations previously assessed (Becker et al., 2011, Swedish Food Agency, 2012). The estimated per capita intakes in the Market Basket 1999 were 74 and 25 µg/day, using 2017-data and 1999-data, respectively. The intakes in the Market Basket 2010 were 75 vs 38 µg/day using 2017-data and 2010-data, respectively. Hence, the difference between studies may be due to chemical analytical issues and should be interpreted with caution. Sugar/sweets (21%), cereal products (18%), vegetables (17%), and meat (16%) contributed the most to the per capita intake (Figure 13).

Copper (Cu)

The estimated per capita intake for copper (1600 µg/day, Table 16) was similar as in 2015 (1400 µg/day (Swedish Food Agency, 2017)) and there were no changes over time (Figure 16). The main contributor to the per capita intake of copper were cereal products (36%), fruits (15%), and sugar/sweets (10%) (Figure 13).

Iron (Fe)

The per capita intake of iron (10 mg/day, Table 16) was similar as in the Market Basket 2015 (11 mg/day (Swedish Food Agency, 2017)), Riksmaten adults 2010-11 (10 mg/day (Amcoff et al., 2012)), and Riksmaten adolescent 2016-17 (8 mg/day (Warensjö Lemming et al., 2018b)). Cereal products (31%), meat (21%), and vegetables (10%) were the main contributors to the per capita intake of iron (Figure 13). There may be a small decreasing trend in per capita intake of iron since 2005 (Figure 16). Possible explanations are the reduced total meat consumption in the population and that pork consumption has decreased with a concomitant increase of poultry (Swedish Board of Agriculture, 2023), causing a small reduction in iron content of the food group meat.

Iodine (I)

The estimated per capita intake of iodine was 170 µg/day (Table 16), which was lower than in Riksmaten adolescents 2016-17 (250 µg/day (Warensjö Lemming et al., 2018b)). In Sweden, table salt is voluntarily iodized (50 µg/gram). Salt is therefore an important iodine source. The discrepancy in intakes was not surprising because household salt is not included in the market basket studies, whereas all household salt is assumed to be iodized in the Riksmaten studies. Hence, the iodine intake is underestimated in the market basket studies and overestimated in the Riksmaten studies, and the true intake is probably in-between. The major sources of iodine intake in the Market Basket 2022 were lean dairy products (22%) and meat (17%) (Figure 13).

Interestingly, the decreasing per capita intake of iodine since 1999 (Market Basket 2015) could not be seen in the present market basket study. Instead, the iodine intake had increased (Figure 16). Higher concentrations were found in several food groups such as pastries, meat, dairy, eggs, and sugar/sweets. There could be several factors that contributed to the higher iodine content in the present market basket study compared with previous. It could be a consequence of increased use of iodized salt in industrial food production. Further, the milk trade organization and industry have decided to increase iodine in fed as a joint effort to increase iodine in milk (Lantbrukarnas Riksförbund, 2023), which could have contributed already. Organic eggs were included in the present market basket study and not in the previous. This could have contributed to higher concentrations in this food group because organic eggs may have slightly higher iodine content than conventional eggs (Gard et al., 2010).

Potassium (K)

Estimated per capita intake of potassium was 4600 mg/day (Table 16). This was much higher than the mean intakes in Riksmaten adults 2010-11 (3100 mg/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (2800 mg/day (Warensjö Lemming et al., 2018b)). Potassium is a common component in food additives (Martinez-Pineda et al., 2021), and its use is increasing (Picard, 2019). The higher intake in the Market Basket 2022 could partly be a reflection of the more up-to-date concentration data used in the market basket compared to the food composition data used in the Riksmaten studies. No clear time trend of per capita intake was seen. A lower per capita intake was observed in the latter two market basket studies compared with earlier studies (Figure 16), but data are possibly affected by sample quality in the analyses of samples from market baskets 1999, 2005 and 2010 in 2017. Estimated per capita intake for 1999 was much lower based on concentrations measured in 1999 (3300 mg/day). The main contributors to the potassium intake were meat (16%), potatoes (14%), and vegetables (13%) (Figure 14).

Magnesium (Mg)

The per capita intake of magnesium (403 mg/day, Table 16) was well above the intakes determined in Riksmaten adults 2010-11 (330 mg/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (290 mg/day (Warensjö Lemming et al., 2018b)). Cereal products (27%), fruits (12%), and meat (11%) were the major sources of the magnesium intake (Figure 14). No changes over time were observed for the per capita intake of magnesium (Figure 16).

Manganese (Mn)

The per capita intake of manganese was 4.8 mg/day (Table 16). This was in line with previous market basket studies, even though a small increasing trend may be indicated (Figure 16). This possible increase seems to be a consequence of increasing concentrations. Cereal products contributed to half of the manganese intake (51%), Figure 14. Intakes of manganese were not assessed in the Riksmaten surveys.

Molybdenum (Mo)

The estimated per capita intake (162 µg/day, Table 16) was in agreement with intakes observed in previous market basket studies (Figure 16). The majority (49%) of the molybdenum intake was from cereal products (Figure 14). Intakes of molybdenum were not determined in the Riksmaten surveys.

Sodium (Na)

Estimated per capita intake of sodium was 2.4 g/day (Table 16), corresponding to 6.0 g salt. This was lower than the sodium intakes observed in Riksmaten adults 2010-11 (3.1 g/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (3.4 g/day (Warensjö Lemming et al., 2018b)). The difference between market basket studies and dietary surveys are not surprising since salt used in the household is excluded from the market basket studies, whereas common generic recipes are used to estimate intake of household salt in the Riksmaten surveys. Nevertheless, the market basket study reflects the sodium exposure from products available on the market. Meat (27%), cereal products (22%), and fatty dairy products (11%) were the major contributors to the per capita intake of sodium.

Interestingly, a decreasing time trend was observed for the last two market basket studies (Figure 16). This change seems to be due to lower concentrations in cereal products, and meat (the largest contributors to sodium intake). Lower sodium contents in pizza/hand pies and processed meat were also assessed in the Market Basket 2022 compared to the Market Basket 2015; 4.6 g/kg vs 3.7 g/kg (pizza/hand pie) and 8.7 g/kg vs 6.4 g/kg (processed meat). These subgroups have no data from other market basket studies, but 25% of the food group meat is processed meat. Therefore, a reduction of sodium in this subgroup also effects sodium content in the meat group. Similarly, lower sodium content in soft bread (60% of cereal products), probably have an impact on sodium content in the food group cereal products. This is in line with data provided by representatives for the industry showing reduced salt content in bread and processed meat (Swedish Food Agency, 2024).

Phosphorus (P)

The per capita intake of phosphorus was 2400 mg/day (Table 16). This was higher than in the Market Basket 2015 (1800 mg/day (Swedish Food Agency, 2017)), Riksmaten adults 2010-11 (1400 mg/day (Amcoff et al., 2012)), and Riksmaten adolescents 2016-17 (1500 mg/day (Warensjö Lemming et al., 2018b)). The higher intake in the market basket studies compared with the Riksmaten surveys could be because food waste is not considered in the market basket studies. Another explanation may be that data in the market basket studies are more up to date compared with the food composition database used in the dietary surveys, and therefore more accurately reflect the current concentrations of foods. This is especially prone for foods containing additive phosphates (Itkonen and Lamberg-Allardt, 2017). Phosphorus is a frequent food additive (Tuominen et al., 2022), and changes in food production and additive use may cause variation in concentrations over time. The estimated intake was higher compared with previous market basket studies with estimated intakes between 1800 and 2100 mg/day (Figure 16). The higher estimated intake in the Market Basket 2022 did not seem to be attributed to a specific food group, and the higher concentrations were observed over several food groups. It should be pointed out that the chemical analyses of minerals between 1999 and 2010 were analysed later in 2017, and this could also affect the results. The main contributors to phosphorus intake were cereal products (21%), meat (20%), and lean and fatty dairy products (15% each) (Figure 14).

Selenium (Se)

The estimated per capita intake of selenium was between 64 and 72 µg/day (Table 16). This was higher than the intakes in Riksmaten adults 2010-11 (46 µg/day (Amcoff et al., 2012)) and Riksmaten adolescents 2016-17 (43 µg/day (Warensjö Lemming et al., 2018b)). There were no clear changes over time. Also, data analysed in 2017 differed from previously analytical data, limiting interpretation of time trend. The estimated per capita intakes in the Market basket 1999 were 52 µg/day based on concentrations analysed in 1999 and 80 µg/day based on concentrations analysed in 2017. The estimated intakes in the Market Basket 2010 were 52 µg/day based on concentrations from 1999 and 112 µg/day based on concentrations from 2017 (Figure 16). Meat (37%) contributed the most to selenium intake, followed by cereal products (15%), fatty dairy products (12%) and eggs (11%) (Figure 15).

Zinc (Zn)

The per capita intake of zinc was 14 mg/day (Table 16). This was slightly higher than the intakes in the Riksmaten studies (11 mg/day) (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). The major contributors to per capita intake of zinc were meat (31%), cereal products (25%), and fatty dairy products (14%), Figure 15. There was no clear time trend, even if the per capita intake was somewhat higher in the Market Basket 2022 compared with previous market basket studies (Figure 16).

Table 16. Mean daily intake of minerals from food groups and total intake in the Market Basket 2022 (N=3 samples per food group).

Food group	Per capita consumption (g/person/day)		Per capita intake (mg/person/day)							Per capita intake (µg/person/day)						
			Ca	Fe	K	Mg	Na	P	Zn	Co	Cr	Cu	I	Mn	Mo	Se
Cereal products	226		121	3.1	609	107	527	511	3.4	2.9	18	571	13	2442	80	9.7
Pastries	55		36	0.63	120	15	155	85	0.47	1.1	10	81	2.7	290	8.8	1.3
Pizza, hand pie[1]	11		16	0.10	29	2.7	41	25	0.17	0.11	1.0	12	0.53	39	1.5	0.47
Meat	194		21	2.1	719	44	633	471	4.3	0.37	16	125	28	76	7.3	24
Processed meat[1]	48		4.9	0.51	161	7.2	308	93	0.77	0.07	1.7	31	1.8	32	1.8	6.7
Lean fish	15		3.3	0.04	38	3.9	48	30	0.08	0.05	0.51	12	10	4.8	0.21	4.0
Fatty fish	18		2.6	0.06	64	5.2	73	48	0.08	0.08	0.32	10	3.1	4.6	0.14	3.1
Meat substitutes	3		2.9	0.08	13	2.1	9.9	7.8	0.04	0.06	0.34	7.8	0.27	31	1.6	0.19
Lean dairy prod.	248	LB HB UB	360	0.07	474	33	80	349	1.1	0.13	0 0 0.56	25	36	10	12	4.5
Fatty dairy prod.	70		450	0.06	66	18	251	368	1.9	0.09	0.55	22	12	9.4	4.2	7.7
Plant-based drinks	13	LB HB UB	13	0.03	25	1.0	4.7	15	0.02	0.06	0.28	7.8	1.7	17	1.8	0 0 0.11
Eggs	29	LB HB UB	17	0.53	46	4.2	37	81	0.42	0.04	0 0 0.06	21	13	18	0.93	7.0
Fats and oils	55		6.2	0.06	24	1.1	175	13	0.05	0.04	0.58	3.6	2.0	5.4	0.72	0.57
Vegetables	245	LB HB UB	61	1.0	617	33	221	100	0.65	1.6	17	142	6.6	396	15	0 0 2.0
Fruits	215	LB HB UB	44	0.67	521	49	41	93	0.51	1.0	5.8	234	8.7	690	14	0.64 1.2 1.8
Potatoes	142	LB HB UB	9.3	0.62	621	36	45	99	0.43	1.1	6.6	137	2.3	189	9.6	0 0 1.2

Food group	Per capita consumption (g/person/day)		Per capita intake (mg/person/day)							Per capita intake (µg/person/day)						
			Ca	Fe	K	Mg	Na	P	Zn	Co	Cr	Cu	I	Mn	Mo	Se
Sugar and sweets	74		61	1.0	208	25	42	93	0.41	4.1	21	153	12	267	5.1	1.2
		LB		0.03					0	0.08	2.5					0
Beverages	262	HB	8.4	0.03	33	3.4	14	21	0	0.09	2.6	4.7	8.8	6.8	0.64	0
		UB		0.04					0.01	0.10	2.8					1.3
		LB									0					0
Coffee and tea	407	HB	21	0.04	399	23	7.1	18	0.03	1.1	0	9.5	6.2	376	0.47	0
		UB									0.81					2.0
		LB									**101**					**64**
Total		**HB**	**1239**	**10**	**4597**	**403**	**2364**	**2404**	**14**	**14**	**101**	**1569**	**167**	**4832**	**162**	**65**
		UB									**103**					**72**
Average requirement[2]			750	9/7	2800	240/280	1500	420	8/11	-	-	700	120	2400	52	60/70
Riksmaten adults[3]			875	10	3119	331	3118	1374	11	-	-	-	-	-	-	46
Riksmaten adolescents[4]			1079	8	2786	293	3352	1510	11	-	-	-	246	-	-	43

LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of detection (LOD) is used for non-detects, except for when all three samples in one food group have concentrations below LOD. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOD is used for non-detects).

[1] Pizza/hand pie and processed meat are subgroups of pastries and meat, respectively, and their intakes are included in pastries and meat. The subgroups were therefore not included when calculation of total per capita intake.

[2] Average requirement according to the Nordic Nutrition Recommendations 2023 for females/males 25-70 years (Blomhoff et al., 2023).

[3] Riksmaten adults 2010-11 (Amcoff et al., 2012).

[4] Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

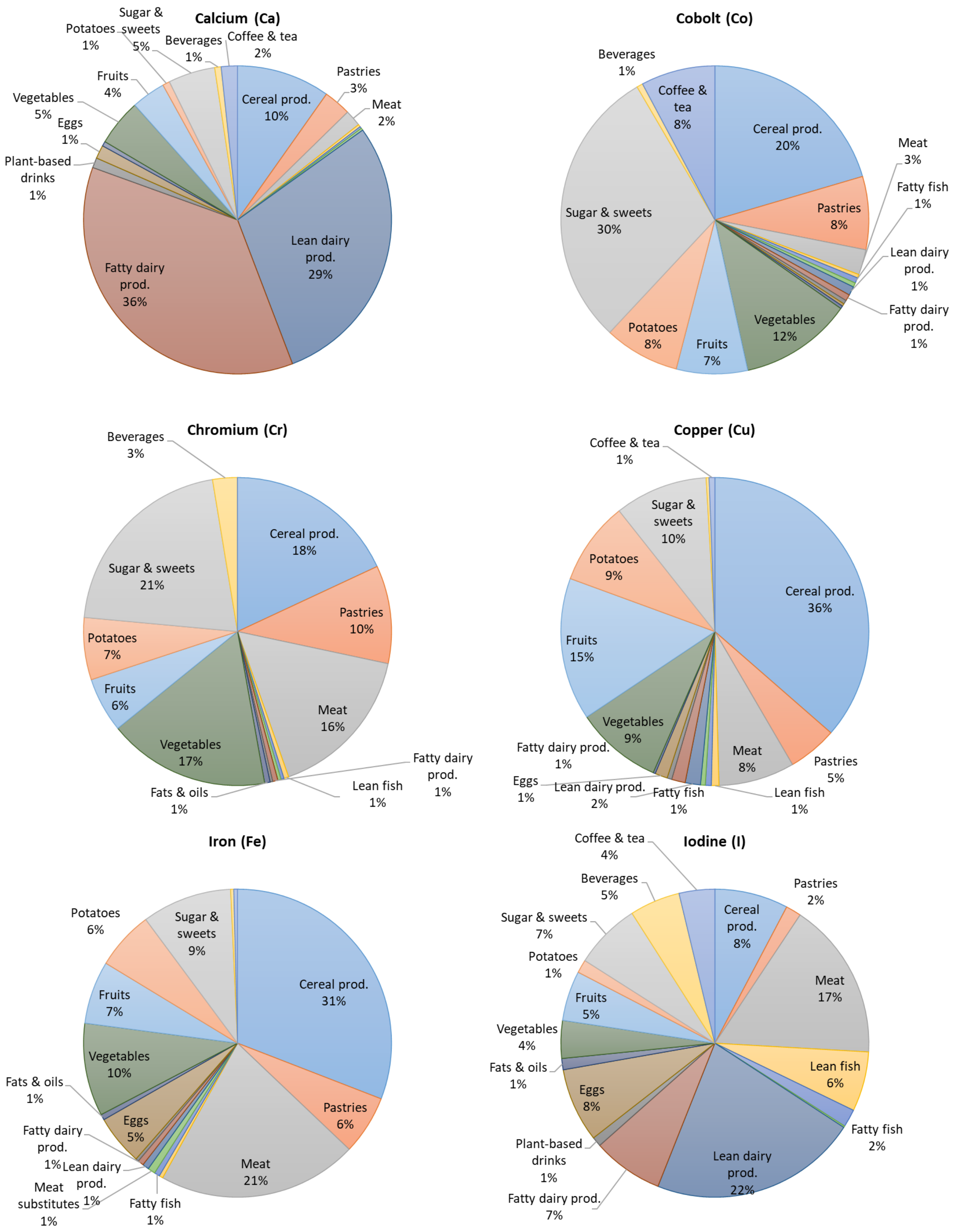

Figure 13. Percentage contribution to the per capita intake of essential minerals (Ca, Co, Cr, Cu, Fe, and I) from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of detection, LOD] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a mineral below LOD. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

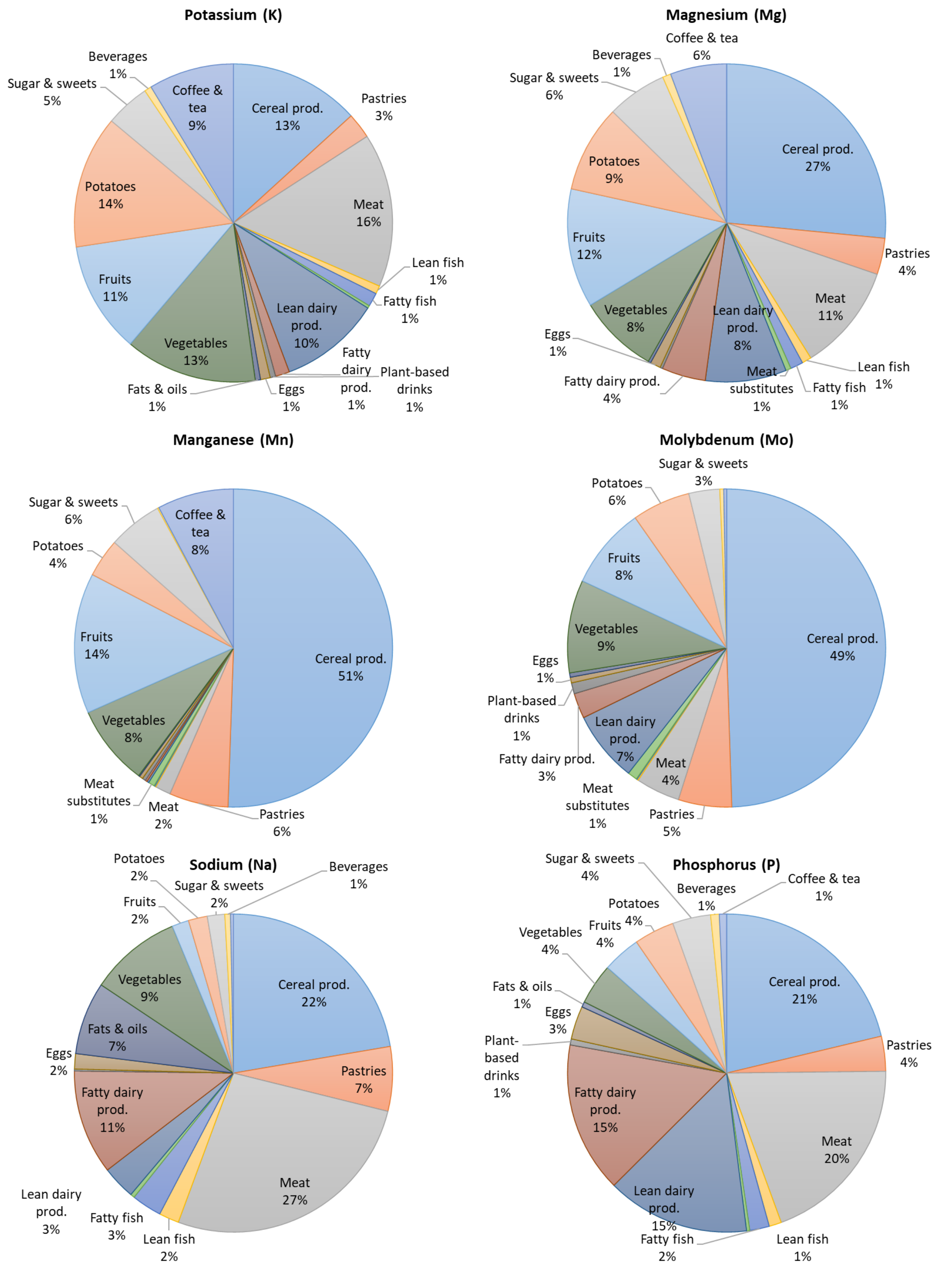

Figure 14. Percentage contribution to the per capita intake of essential minerals (K, Mg, Mn, Mo, Na, and P) from different food groups in the Market Basket 2022.
Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of detection, LOD] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a mineral below LOD. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

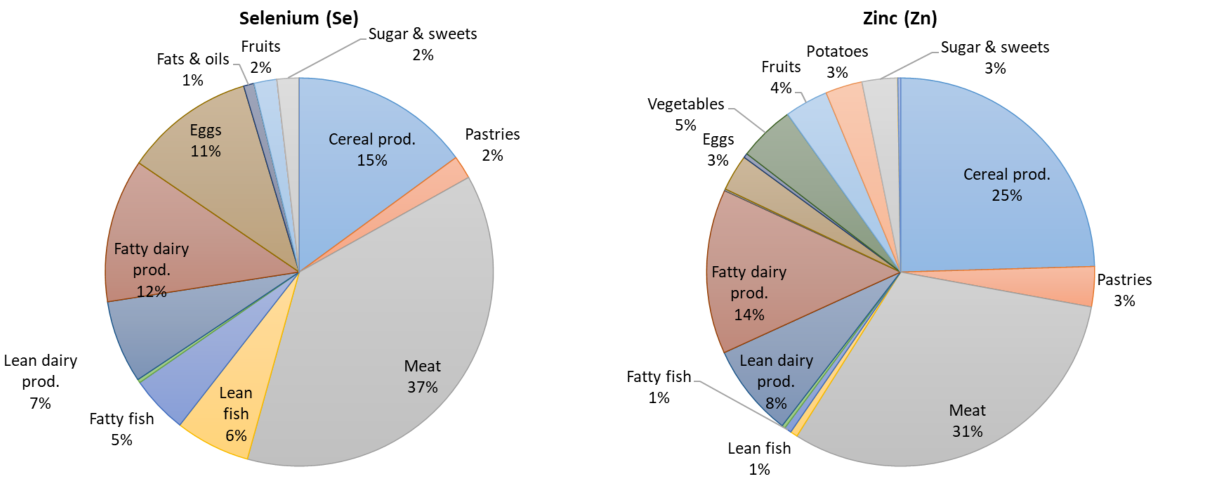

Figure 15. Percentage contribution to the per capita intake of essential minerals (Se, and Zn) from different food groups in the Market Basket 2022.

Food groups contributing less than 1% are only presented graphically in the pie chart, and not with text. The percentage is based on mean per capita intake per food group. Hybrid bound were used when calculating means (i.e., medium bound concentration [0.5*limit of detection, LOD] was imputed for non-detects, with exception for when all three samples in one food group had concentrations of a mineral below LOD. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

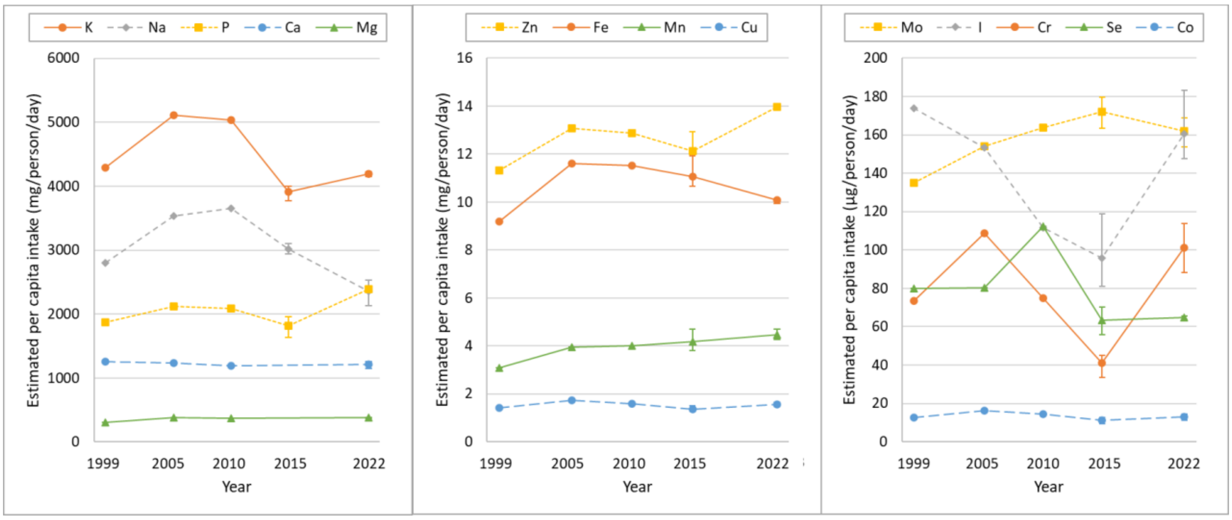

Figure 16. Estimated per capita intake of essential minerals in market basket studies over time.

Note, that the per capita intake is a function of per capita consumption and compound concentrations in the food groups. Intake from coffee and tea is not included. Vertical lines indicate minimum and maximum values in the Market Basket 2015 and 2022. Number of samples per food group was: N=1 (1999), N=1 (2005), N=1 (2010), N=5 (2015), N=3 (2022).

8.4.3 Risk and benefit assessments

Assessments of benefits or risks with the per capita intakes in the Market Basket 2022 was mainly evaluated using AR and UL for adults 25-50 years as defined in the NNR (Blomhoff et al., 2023). Provisional AR was used if no AR was established. Per capita intakes were also compared with RI or adequate intakes (AI) for adults 25-50 years as defined in NNR (Blomhoff et al., 2023).

Figure 17 shows the per capita intake related to AR or provisional AR. Value below one indicates insufficient intake at population level. For all analysed minerals, the estimated per capita intakes were above AR, indicating adequate intakes at population level. However, there seemed to be a small margin for iron and selenium.

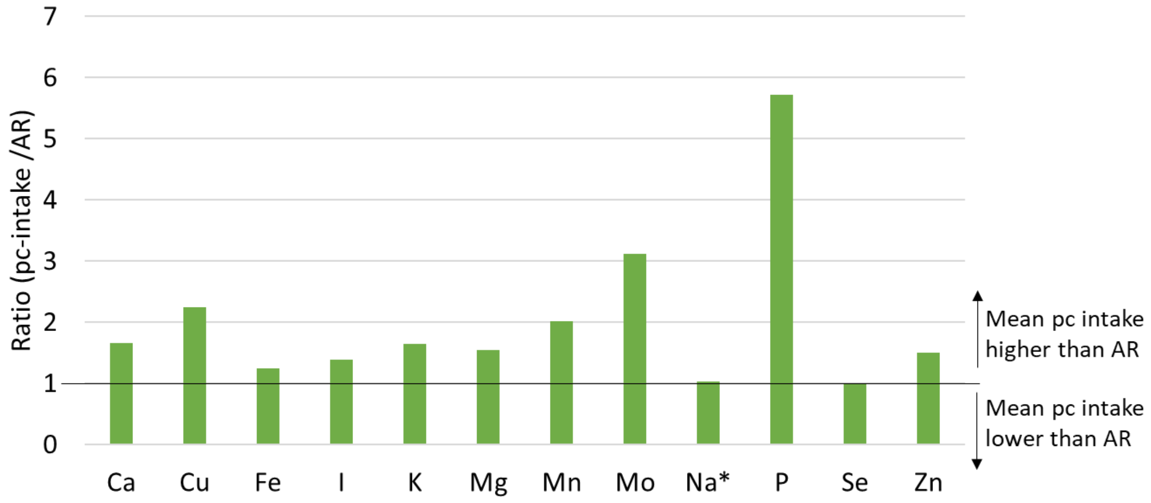

Figure 17. Estimated per capita (pc) intake of minerals in the Market Basket 2022 in relation to average requirement (AR) or provisional AR.
Recommendations for adults 25-50 years are used (Blomhoff et al., 2023). Mean AR was used if AR was different for men and women. Please note that household salt was not included in the study, especially underestimating the intakes of iodine and sodium.
*For sodium, the comparison was not made with AR but with the chronic disease risk reduction intake, i.e. the intake level for when a reduction of chronic disease risk is expected in the general population.

Calcium (Ca)

Calcium is important for skeleton and teeth, but also muscle contraction, nervous system, and blood clotting. AR is based on maintaining a healthy skeleton (Blomhoff et al., 2023). Per capita intake of calcium (1200 mg/day, Table 16) was above the AR (750 mg/day) and RI (950 mg), and below UL (2500 mg/day) (Blomhoff et al., 2023). AR was also reached in Riksmaten adults 2010-11 (Amcoff et al., 2012) and Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

Cobalt (Co)

Cobalt is a component for vitamin B12 (cobalamin), which is involved in cell metabolism and the production of red blood cells. There are no established recommended intake or average requirement for cobalt by EFSA or NNR (Blomhoff et al., 2023).

Chromium (Cr)

The biological functions of chromium are not yet determined but it is considered to be involved in insulin sensitivity and cholesterol metabolism (Blomhoff et al., 2023). At present, there are no convincing evidence that chromium is an essential nutrient and therefore no intake recommendations or UL are set by EFSA (EFSA Panel on Dietetic Products et al., 2014a) or NNR (Blomhoff et al., 2023). The per capita intake of 101 µg/day (Table 16) was above the adequate intakes set by US Institute of Medicine (25 µg/day for females and 35 µg/day for males) (Institute of Medicine (US) Panel on Micronutrients, 2001).

Copper (Cu)

Copper is a structural component in many proteins. The estimated per capita intake for copper (1600 µg/day, Table 16) was far above AR of 700 µg/day and RI of 900 µg/day (Blomhoff et al., 2023). The intake corresponds to 0.02 mg/kg bw/day. This is below the UL for adults based on copper retention as an early marker of potential adverse effects of 5 mg (corresponding to 0.7 mg/kg bw/day) (Blomhoff et al., 2023).

Iron (Fe)

Iron is essential for transportation of oxygen and functions of many enzymes. The estimated per capita intake of iron in the Market Basket 2022 (10 mg/day, Table 16) was in accordance with AR (9 and 7 mg/day for females and males, respectively) (Blomhoff et al., 2023). AR was also reached in Riksmaten adults 2010-11 (Amcoff et al., 2012). However, the estimated intake in the Market Basket 2022 is average in the population and there are groups (e.g. infants, young children, menstruating or pregnant women, and vegetarians) at risk of iron deficiency in the Nordic countries (Blomhoff et al., 2023). Further, a per capita intake of 10 mg/day meets the AR of all population groups, except for pregnant women (Blomhoff et al., 2023). Because of the narrow margin to AR and that the market basket studies tend to overestimate the intake due to not considering food waste, there is a risk that AR is not reached in all groups. A decreasing trend of iron intake since 2005 was indicated. If this trend continues, this could increase the number of individuals with inadequate iron status. RI for males (9 mg/day) but not females (15 mg/day) were reached (Blomhoff et al., 2023), further empathizing women to be at the highest risk for deficiency.

AR for pregnant women is 20 mg/day and was far above the estimated per capita intake. It was also higher than the intakes in fertile females in Riksmaten adults 2010-11 (around 9-10 mg/day, (Amcoff et al., 2012)), and in Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b). In the latter, around 30% of the teenage girls had plasma ferritin concentrations indicating risk for iron deficiency anaemia (Warensjö Lemming et al., 2018b). Because pregnant women are at risk for iron deficiency anaemia, their status is monitored during pregnancy.

There was a margin to UL set to 60 mg/day in the NNR (Blomhoff et al., 2023) and to the safe level of intake of 40 mg/day suggested by EFSA (EFSA Panel on Nutrition et al., 2024).

Iodine (I)

Iodine is an essential component of the thyroid hormones and thereby important for metabolic regulation and growth. The estimated per capita intake of iodine is probably underestimated at population level because of the exclusion of iodized household salt. Despite this, the intake (170 µg/day, Table 16) was above the provisional AR (120 µg/day) and AI (150 µg/day) (Blomhoff et al., 2023). The decreasing time trend of estimated iodine intake observed in previous market basket studies was not continued and the intake had increase in the Market Basket 2022. Adequate iodine intake was also reported in Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b). The UL of iodine is 600 µg/day (Blomhoff et al., 2023).

Potassium (K)

Potassium is essential for normal cell functions and fluid balance. The intake recommendation is based on associations between potassium intake and normal blood pressure (Blomhoff et al., 2023). Estimated per capita intake of potassium was 4600 mg/day (Table 16), which was far above the provisional AR of 2800 mg/day and AI of 3500 mg/day (Blomhoff et al., 2023). Intakes above AR was also seen in Riksmaten adults 2010-11 (Amcoff et al., 2012) and Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b). There is no UL for potassium in NNR (Blomhoff et al., 2023).

Magnesium (Mg)

Magnesium is a cofactor of many enzymes and essential for several physiological processes. The provisional AR for magnesium (240 and 280 mg/day for females and males, respectively (Blomhoff et al., 2023)) was far reached by the estimated per capita intake of 400 mg/day (Table 16). The intake was also above RI (300 and 350 mg/day for females and males, respectively) (Blomhoff et al., 2023). Intakes above AR was also seen in Riksmaten adults 2010-11 (Amcoff et al., 2012) and Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b). There is no UL for magnesium from diets. UL in dietary supplements is set to 250 mg/day (Blomhoff et al., 2023).

Manganese (Mn)

Manganese is essential and involved in synthesis and activation of enzymes. The estimated mean intake in the Market Basket 2022 (4.8 mg/day, Table 16) was far above the provisional AR (2.4 mg/day) and AI (3 mg/day) (Blomhoff et al., 2023). There is no UL set for manganese (Blomhoff et al., 2023).

Molybdenum (Mo)

Molybdenum serves as a cofactor in some enzymes. The estimated per capita intake (162 µg/day, Table 16) was more than twice as high as the provisional AR (52 µg/day) and AI (65 µg/day) (Blomhoff et al., 2023). There was a margin to the UL, which is set to 600 µg/day (Blomhoff et al., 2023).

Sodium (Na)

Sodium is important for the intra- and extracellular osmolality. An intake of 1.5 g/day is estimated sufficient for maintained sodium balance and set as the lower intake level (Blomhoff et al., 2023). High sodium intakes are associated with high blood pressure and mortality (Blomhoff et al., 2023). The estimated per capita intake of sodium was 2.4 g/day (Table 16), which is equivalent to 6.0 g salt (NaCl). Despite that salt intake is underestimated in the market basket studies due to the exclusion of household salt, the estimated mean intake was 1.6 times higher than the recommended adequate intake of 1.5 g/day (corresponding to 3.75 g/day of salt) (Blomhoff et al., 2023). A sodium intake of 2.4 g/day is also higher than the chronic disease risk reduction of 2.3 g/day (5.75 g salt). Lowering the intake below this level is expected to reduce chronic disease risk within the general population (Blomhoff et al., 2023). This shows that the population target of 2.3 g/day of sodium is exceeded, even if no salt is used in the household at all. If adding sodium estimated by salt consumption in the statistics from the SBA (2.7 g salt/day or 1.1 g sodium/day (Swedish Board of Agriculture, 2021b)), total per capita intake of sodium was estimated to 3.4 g/day, corresponding to 8.6 g salt/day. Too high intakes of sodium and salt was also reported in the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). A decreasing trend of sodium seen in the Market Basket 2022, indicates lower sodium exposure from products such as pizza/hand pies, and processed meat. This is beneficial considering that these groups each contributes to more than 5% of the sodium intake (Swedish Food Agency and Löfvenborg, 2023).

Phosphorus (P)

Phosphorus is important for the bone mineralization, cell structure and cellular metabolism. The estimated per capita intake in the population (2400 mg/day, Table 16) was almost six times higher than the provisional AR (420 mg/day (Blomhoff et al., 2023)). High intakes of phosphorus have adverse effects on kidney, bone and cardiovascular health and UL is set to 3000 mg/day (Blomhoff et al., 2023). Hence, there was a small margin between estimated per capita intake and UL. High intakes have also been seen in the Riksmaten surveys with medians between 1300 and 1800 mg/day and 95th percentiles between 2100 and 2900 mg/day (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). If there is an increasing time trend, this may be troublesome for individuals with kidney disease considering that there is no product labelling for phosphorus. Higher intake of phosphorus is associated with increased mortality in patients with severe chronic kidney disease (Hou et al., 2017, Da et al., 2015), but not with milder disease (Murtaugh et al., 2012). We did not consider whether the phosphorus was natural (organic) or added (inorganic), which could be relevant due to their different bioavailabilities. Added inorganic phosphorus have higher bioavailability (80-100%) than natural phosphorus (less than 60%). Of the organic sources, animal-derived phosphorus are more easily absorbed than plant-derived (Calvo et al., 2014).

Selenium (Se)

Selenium is an essential component of antioxidant enzymes and important for normal function of the thyroid hormones. The estimated average intake in the population (64-72 µg/day, Table 16) was equivalent the provisional AR (60 µg/day for females and 70 µg/day for males (Blomhoff et al., 2023)). Hence, the intake at a population level seems to be sufficient. However, it should be kept in mind that food waste is not included in the Market Basket 2022, which overestimates the intake. Therefore, there may be a narrow margin to AR. A low selenium intake in the population was also obtained in the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b), were all population groups were below AR based on the NNR (Blomhoff et al., 2023).

High intakes of selenium may cause adverse effects on liver, peripheral nerves, skin, nails, and hair, but the estimated intake was far below UL (255 µg/day) (Blomhoff et al., 2023).

Zinc (Zn)

Zinc is an essential element with structural and catalytic roles in all seven classes of enzymes. The AR of 8.1 mg/day for females and 10.6 mg/day for males (Blomhoff et al., 2023) were reached by the estimated average intake in the population (14 mg/day, Table 16). Dietary phytate inhibit zinc absorption. Therefore, plant-based diets can increase the need of zinc from diets. AR at a higher phytate intake of 1200 mg/day (instead of 600 mg/day) are set to

10 mg/day for females and 13 mg/day for males. Hence, the per capita intake of zinc is slightly above AR even at higher phytate intakes (EFSA Panel on Dietetic Products et al., 2014b). Adequate intakes were also obtained in the Riksmaten surveys (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). There was a margin to UL of zinc set to 25 mg/day (Blomhoff et al., 2023).

8.4.4 Conclusion

The estimated population average supplies of the fourteen essential minerals analysed in the Market Basket 2022, and for which there was an AR, were above AR (i.e. calcium, chromium, copper, iron, potassium, magnesium, manganese, molybdenum, phosphorus, selenium, and zinc). No assessment was made for cobalt as no dietary reference values were available. Most of the minerals were above AR with a marginal. This could strengthen the accuracy of the conclusion of an adequate intake at populational level, considering that the market basket studies do not adjust for food waste, and thereby overestimate the per capita intake. However, the estimated supplies of selenium and iron indicate risk for deficiency of these minerals in the population. In contrast, the estimated population mean intake of sodium from foods was too high. The high supply of phosphorus indicates a narrow span to levels where it could have health implications.

The estimated average intake of selenium was in line with AR. However, because the estimations in the market basket studies tend to overestimate the actual intake, the narrow margin indicates that there is a risk of selenium deficiency in the population. The recommended intake of selenium was increased in the updated NNR (Blomhoff et al., 2023), with the result that both adults and adolescents in the Riksmaten surveys also are below AR (Amcoff et al., 2012, Warensjö Lemming et al., 2018b). Taken together, the mean selenium intake in the Swedish population indicates a risk of insufficient intake at populational level.

The estimated intake of iron was in accordance with AR but the margin for especially females was small. This indicates that fertile women could be at risk for iron deficiency anaemia, which is in line with results from Riksmaten adolescents 2016-17 (Warensjö Lemming et al., 2018b).

Even though the estimated intake of sodium in the Market Basket 2022 is underestimated, due to the exclusion of household salt, the intake was at a level where it is expected to increase the risk of chronic disease in the general population. However, a decreasing time trend of sodium intake was seen and if it continues, this is expected to have beneficial public health effects.

For phosphorus, there was a small margin between estimated supply and UL. A high intake of phosphorus has adverse effects on kidneys, but also bone and cardiovascular health. A high intake could be problematic for especially people with chronic kidney disease because of limited capacity to remove phosphorus from the body.

8.5 Metals

There are several metals found in food. Some are toxic to humans and are present in the food mainly due to their natural presence. Arsenic though semi metallic is sometimes included in the category of metals as well. Some, like cadmium and lead, occur at elevated levels due to human activity and others like silver and aluminium occur naturally but may also be added as food additives. Seven metals were analysed to give their total content in the different food categories: aluminium (Al), silver (Ag), cadmium (Cd), mercury (Hg), lead (Pb), arsenic (As) and nickel (Ni). For arsenic, additional analyses were performed to obtain the content of inorganic arsenic (iAs), which is considered the most toxic form of arsenic that is present in food.

ALS Scandinavia performed the chemical analyses using HC-ICP-MS. The analysis of inorganic arsenic was performed by HPLC-ICP-MS at the Swedish Food Agency. The chemical analyses are described in more detail in Appendix 4 (section A4.4). Limits of detection are shown in Table 17.

Table 17. Limits of detection for analyses of metals in the Market Basket 2022.

Type of sample	Limits of detection (µg/kg)							
	Al	Ag	As	iAs*	Cd	Hg	Ni	Pb
Solid	90	0.24	0.44	6.7	0.02	0.35	2	0.30
Liquid	50	0.05	0.5	2.7	0.05	0.2	2	0.5

*In the analysis of iAs in fish it was hard to separate two similar peaks which lead to a high LOQ of 10 µg/kg.

8.5.1 Concentrations in food groups

Levels of metals in the different food groups in the Market Basket 2022 are presented in Table 18.

Arsenic (As)

The analysis of arsenic was divided into the total amount of arsenic, tAs, and inorganic arsenic, iAs. Fish contained the highest levels of tAs (mainly organic forms), when comparing all food categories. The mean levels in fatty fish were 1100 µg tAs/kg and the mean for lean fish was 4980 µg tAs/kg.

For inorganic arsenic the highest level was found in cereals with a mean concentration of 9.4 µg/kg followed by meat substitutes with a mean concentration of 3.3 µg/kg. In the analysis of iAs in fish it was hard to separate two similar peaks which caused a high LOQ.

Aluminium (Al)

Meat substitutes contained the highest levels of aluminium with a mean level of 6706 µg/kg followed by pizza and hand pie with a mean exposure of 5300 µg/kg.

Silver (Ag)

Lean fish products contained the highest levels of silver with a mean level of 11 µg/kg followed by potatoes with a mean level of 0.96 µg/kg.

Cadmium (Cd)

Cereal products contained the highest levels of cadmium with a mean level of 30 µg/kg followed by potatoes with a mean level of 26 µg/kg.

Mercury (Hg)

Fish was the category with the highest level of mercury, with a concentration of 30 µg/kg in lean fish and 20 µg/kg in fatty fish.

Nickel (Ni)

The highest concentration of nickel was in sugar and sweets (559 µg/kg). Noteworthy is that plant-based drinks had second highest concentration of nickel (352 µg/kg), especially considering that can more easily be consumed in large amounts. These have not been analysed in the market basket before.

Lead (Pb)

Meat substitutes had the highest concentration of lead with a mean concentration of 3.6 µg/kg followed by pastries with a mean concentration of 2.6 µg/kg. Vegetables were the main contributor to exposure, accounting for around 24% of the total exposure. Cereals also contributed about 18% to exposure.

Table 18. Concentrations of metals in food groups in the Market Basket 2022 (N=3 per food group). All concentrations are given in µg/kg. Inorganic arsenic was not measured in all food groups, which is indicated by NA.

		Cereal products	**Pastries**	***Pizza, hand pie***	**Meat**	***Processed meat***	**Lean fish**	**Fatty fish**	**Meat substitutes**	**Lean dairy products**	**Fatty dairy products**	**Plant-based drinks**	**Eggs**	**Fats and oils**	**Vegetables**	**Fruits**	**Potatoes**	**Sugar and sweets**	**Beverages**	**Coffee and tea**
Ag	Mean	0.87	0.31	0.38	<0.24	<0.24	11	0.3	0.29	<0.050	<0.24	<0.050	<0.24	<0.24	0.26	0.17	0.96	<0.24	<0.050	<0.050
(µg/kg)	Min	0.74	0.25	0.28	<0.24	<0.24	8.0	0.12	0.12	<0.050	<0.24	<0.050	<0.24	<0.24	0.19	0.12	0.49	<0.24	<0.050	<0.050
	Median	0.83	0.32	0.43	<0.24	<0.24	11	0.27	0.12	<0.050	<0.24	<0.050	<0.24	<0.24	0.27	0.12	1.1	<0.24	<0.050	<0.050
	Max	1.1	0.34	0.45	<0.24	<0.24	13	0.51	0.65	<0.050	<0.24	<0.050	<0.24	<0.24	0.31	0.28	1.3	<0.24	<0.050	<0.050
Al	Mean	4205	3111	5300	443	930	493	275	6706	96	242	959	<90	313	1863	1419	628	4431	66	798
(µg/kg)	Min	1316	2128	4834	301	515	478	248	5844	45	174	829	<90	211	1015	1074	555	4237	25	751
	Median	1371	3100	4918	454	935	479	250	6170	45	180	10244	<90	337	1533	1440	635	4397	63	787
	Max	2007	4103	6147	575	1339	521	326	8103	200	371	1025	<90	392	3039	1744	694	4659	111	856
As	Mean	14	3.9	3.8	2.8	2.7	4980	1100	6.5	1.3	9.3	3.1	7.0	4.2	2.2	4.7	2.4	5.1	0.78	0.33
(µg/kg)	Min	9.6	2.5	3.4	2.2	2.1	3069	934	5.1	0.69	2.0	2.7	6.0	3.6	1.8	2.6	1.7	4.3	0.62	0.25
	Median	11	3.6	3.3	2.5	2.3	4135	1037	6.1	1.2	7.8	2.9	7.3	4.2	1.9	4.5	1.9	5.1	0.74	0.25
	Max	20	5.6	4.3	3.9	3.9	7737	1330	8.4	2.1	18	3.6	7.8	4.9	3.0	7.0	3.6	6.1	0.98	0.51
iAs	Mean	9.4	NA	NA	NA	NA	<10	<10	3.3	NA	NA	1.7	NA	NA	1.3	2.9	NA	2.5	NA	<0.4
(µg/kg)	Min	8.1					<10	<10	2.7			1.5			1.1	1.8		1.6		<0.4
	Median	9.5					<10	<10	3.4			1.5			1.3	2.1		2.1		<0.4
	Max	10.5					<10	<10	3.8			2.0			1.7	4.7		3.6		<0.4
Cd	Mean	29	16	13	1.3	0.82	11	2.1	11	0.053	0.11	1.9	0.047	0.45	12	1.6	26	7.2	<0.05	0.072

		Cereal products	Pastries	*Pizza, hand pie*	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea
(µg/kg)	Min	25	16	12	0.93	0.64	8.8	1.3	10	0.044	0.091	1.5	0.028	0.35	11	1.3	22	6.6	<0.05	0.025
	Median	29	16	12	1.2	0.89	9.9	1.9	11	0.055	0.12	1.7	0.046	0.48	12	1.3	25	7.1	<0.05	0.095
	Max	34	16	15	1.8	0.92	17	3.0	12	0.061	0.13	2.6	0.066	0.51	14	2.2	30	8.1	<0.05	0.096
Hg	Mean	0.96	<0.35	0.23	<0.35	<0.35	29	20	0.24	<0.2	<0.35	<0.2	2.4	<0.35	<0.35	<0.35	<0.35	<0.35	<0.2	<0.2
(µg/kg)	Min	0.69	<0.35	0.17	<0.35	<0.35	22	17	0.17	<0.2	<0.35	<0.2	2.2	<0.35	<0.35	<0.35	<0.35	<0.35	<0.2	<0.2
	Median	1.0	<0.35	0.17	<0.35	<0.35	31	19	0.17	<0.2	<0.35	<0.2	2.3	<0.35	<0.35	<0.35	<0.35	<0.35	<0.2	<0.2
	Max	1.2	<0.35	0.35	<0.35	<0.35	34	23	0.39	<0.2	<0.35	<0.2	2.5	<0.35	<0.35	<0.35	<0.35	<0.35	<0.2	<0.2
Ni	Mean	246	253	85	58	43	25	16	285	5.6	10	351	1.3	11	109	156	65	559	8.2	11
(µg/kg)	Min	234	213	81	11	17	21	9.3	213	2.2	7.1	221	1.0	9.2	83	116	59	504	2.0	9.3
	Median	243	270	83	19	19	26	16	279	2.5	10	242	1.0	12	101	169	60	539	3.0	11
	Max	260	277	93	144	93	28	23	363	12	12	591	2.0	12	144	182	77	633	20	13
Pb	Mean	1.9	2.6	2.7	1.3	1.1	1.0	0.61	3.6	<0.5	0.94	0.88	0.18	0.46	2.4	1.4	0.74	3.2	0.34	0.51
(µg/kg)	Min	1.2	1.7	2.4	0.67	0.61	0.5	0.45	3.3	<0.5	0.73	0.76	0.15	0.28	1.4	1.3	0.69	3.0	0.25	0.25
	Median	2.1	2.6	2.6	0.75	1.2	0.81	0.47	3.6	<0.5	0.81	0.77	0.15	0.43	1.8	1.5	0.72	3.3	0.25	0.51
	Max	2.5	3.4	2.9	2.3	1.3	1.4	0.91	3.9	<0.5	1.3	1.1	0.26	0.68	4.0	1.5	0.81	3.4	0.52	0.77

8.5.2 Exposure estimations and time trends

Estimated mean intakes of the metals in the Swedish population (per capita intakes) are shown in Table 19. The proportional contribution of each food group to the per capita intakes are presented in Figure 18. The food group cereal products was an important contributor for most of the analysed metals. For mercury and total arsenic, fish was by far the greatest contributor. Figure 19 illustrates changes in estimated per capita intake of metals in market basket studies since 1999. Per capita intakes in 1999, 2005, and 2010 were estimated by pooled samples analysed in year 2017. Concentrations were analysed in one pooled sample per food group and market basket study.

Arsenic (As)

Fish was the largest contributor to total arsenic exposure, with lean fish contributing 77% and fatty fish contributing 20% to the exposure. Cereals were the largest contributor to exposure for inorganic arsenic, accounting for 64% of the exposure. The present calculated intake of total arsenic (tAs) was 102 µg/day. As for inorganic arsenic, the estimated exposure was 0.047 µg/kg bw/day. This is higher than what was calculated for the Market basket 2015, and is in line with exposure estimates for the European population by EFSA (EFSA et al., 2021). Mean dietary exposure estimates for inorganic arsenic ranged from 0.03 to 0.15 µg/kg bw/day (min LB–max UB) for adults.

Aluminium (Al)

Vegetables were the main contributor to exposure, contributing around 23 % of the total exposure. The present calculated intake of aluminium was 32 µg/kg bw/ day or 0.22mg/kg bw/week. In EFSAs estimate the daily dietary exposure to aluminium in the general population, across several European countries, varied from 0.2 to 1.5 mg/kg bw/week (mean) and was up to 2.3 mg/kg bw/week for highly exposed consumers (EFSA, 2008). The estimate from this Market basket is in the lower end of the range. Based on results from market basket studies aluminium exposure has remained relatively unchanged since 1999 with the exception of 2010 for which we do not have an explanation.

Silver (Ag)

Cereals were the main contributor to exposure, contributing around 30 % of the total exposure. The present calculated intake of silver was 0.66 µg/person/ day. This is lower than previous market baskets. This is also lower than what EFSA estimated based on a TDS from ANSES. For adults, the mean exposure ranged from 1.29 µg/kg bw/day (lower bound) to 2.65 µg/kg bw/day (upper bound) (EFSA ANS Panel (EFSA Panel on Food Additives and Nutrient Sources Added to Food), 2016).

Cadmium (Cd)

Cereals were the main contributor to exposure, accounting for around 42 % of the total exposure the other main contributors are potatoes (23%) and vegetables (20%). The present calculated intake of cadmium was 16 µg/person/ day or 1.6 µg/kg bw/week. This exposure is higher than in previous market baskets. Part of the explanation for this difference can be explained by higher Cd concentrations in the main contributors, i.e. cereals, vegetables, and potatoes. Another part of the explanation was a higher consumption of vegetables and potatoes. This estimate is however in line with the medium bound exposure estimate for Swedish adults from EFSA 1.77 µg/kg bw/week (EFSA, 2012a).

Mercury (Hg)

Fish was the main contributor to the exposure contributing around 74% of the total exposure. The present calculated intake of Mercury was 1.1 µg/person/ day or 0,11 µg/kg bw/week. This estimate is the lowest we have measured in any market basket study. The estimate is in line with but lower than the EFSA medium bound assessment of methylmercury from 2012 with a median of 0.24 µg/kg bw/ week for adults(EFSA, 2012c).

Nickel (Ni)

The largest contributor to the exposure was cereals contributing around 28% of the total exposure. The present calculated intake of nickel was 208 µg/person/ day, or 3 µg/kg bw/ day. This is in line with the exposure estimates from EFSA for the European general population, that range from 2.9 to 3.4 µg/kg bw/ day for adults ((EFSA Panel on Contaminants in the Food Chain (CONTAM) et al., 2020). There was no clear trend in the per capita exposure estimates from earlier market baskets but the estimates from 2015 and 2022 were lower than previous estimates.

Lead (Pb)

Vegetables were the main contributor to exposure, accounting for around 24% of the total exposure. Cereals also contributed about 18% to exposure. The present calculated intake of lead was 0.036 µg/kg bw/ day. This is the lowest lead exposure level measured in the Market basket since measurements started in 1999. It is also lower than the exposure estimate from EFSA of 0.50 µg/kg bw/ day for the general adult population of Europe (EFSA, 2012b). Most of the food groups had levels half of what was measured in 2015 and for sugar and sweets the level of lead decreased from 11 µg/kg to 3.2 µg/kg. A lower level of exposure fits with the observation that has emerged from monitoring of lead in blood. A trend towards lower amounts in blood has been seen since the phase out of leaded gasoline in Sweden (Stajnko et al., 2024).

Table 19. Mean daily intake of metals from food groups and total intake in the Market Basket 2022 (N=3 per food group).

Food group	Per capita consumption (g/person/day)		Per capita intake (µg/person/day)							
			Ag	Al	tAs	iAs	Cd	Hg	Ni	Pb
Cereal products	226	HB	0.20	345	3.1	2.1	6.7	0.21	56	0.44
		LB						0		
Pastries	55	HB	0.017	171	0.21	NA	0.91	0	14	0.15
		UB						0.20		
		LB						0.0013		
Pizza, hand pie[1]	11	HB	0.0043	58	0.042	NA	0.15	0.0026	0.98	0.029
		UB						0.0026		
		LB	0					0		
Meat	194	HB	0	86	0.54	NA	0.26	0	11	0,25
		UB	0.047					0.068		
		LB	0					0		
Processed meat[1]	48	HB	0	45	0,13	NA	0.039	0	2.1	0.050
		UB	0.011					0.017		
		LB				0				
Lean fish	15	HB	0.17	7.4	75	0	0.18	0.45	0.39	0.015
		UB				0.15				
		LB	0.0047			0				
Fatty fish	18	HB	0.0054	5.0	20	0	0.038	0.36	0.29	0.011
		UB	0.0062			0.18				
		LB	0.00065					0		0.046
Meat substitutes	3	HB	0.0009	20	0.021	0.0098	0.034	0	0.86	0.091
		UB	0.0011					0.053		0.13
		LB	0	17				0		0
Lean dairy products	248	HB	0	25	0.33	NA	0.013	0	1.4	0
		UB	0.013	30				0.050		0.13
		LB	0					0		
Fatty dairy products	70	HB	0	17	0.65	NA	0.0084	0	0.71	0.067
		UB	0.017					0.025		
		LB	0					0		
Plant-based drinks	13	HB	0	12	0.040	0.021	0.025	0	4.6	0.011
		UB	0.00065					0.0026		
Eggs	29	LB	0	0	0.20	NA	0.0014	0.068	0.020	0.0026

Food group	Per capita consumption (g/person/day)		Per capita intake (µg/person/day)							
			Ag	Al	tAs	iAs	Cd	Hg	Ni	Pb
		HB	0	0					0.039	0.0055
		UB	0.069	2.6					0.039	0.0084
		LB	0					0		
Fats and oils	55	HB	0	17	0.23	NA	0.025	0	0.64	0.026
		UB	0.0027					0.020		
		LB						0		
Vegetables	245	HB	0.064	456	0.55	0.33	3.2	0	27	0.60
		UB						0.084		
		LB	0.020					0		
Fruits	215	HB	0.037	305	1.0	0.62	0.34	0	34	0.31
		UB	0.055					0.077		
		LB						0		
Potatoes	142	HB	0.14	89	0.34	NA	3.7	0	9.3	0.11
		UB						0.050		
		LB	0					0		
Sugar and sweets	74	HB	0	328	0.38	0.18	0.54	0	41	0.24
		UB	0.018					0.026		
		LB	0	15			0	0		0.046
Beverages	262	HB	0	17	0.20	NA	0	0	2.2	0.091
		UB	0.063	20			0.013	0.053		0.13
		LB	0		0.07		0.029	0		0.18
Coffee and tea	407	HB	0	325	0.14	NA	0.029	0	4.7	0.21
		UB	0.020		0.2		0.033	0.084		0.25
		LB	**0.61**	**2225**	**102**	**3.3**	**16**	**1.1**	**208**	**2.5**
Total		**HB**	**0.63**	**2236**	**102**	**3.3**	**16**	**1.1**	**208**	**2.7**
		UB	**0.91**	**2242**	**102**	**3.6**	**16**	**1.9**	**208**	**2.9**
µg/kg bw/day		**HB**	**0.0089**	**32**	**1.5**	**0.047**	**0.23**	**0.016**	**3**	**0.036**

LB, lower bound (i.e. 0 is used for non-detects); HB, hybrid bound (i.e. 0.5*limit of quantification (LOQ) is used for non-detects, except for when all three samples in one food group have concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects); UB, upper bound (i.e. LOQ is used for non-detects). Pizza/hand pie and processed meat are subgroups of pastries and meat, respectively, and their intakes are included in pastries and meat. The subgroups are therefore not included when calculation of total per capita intake.

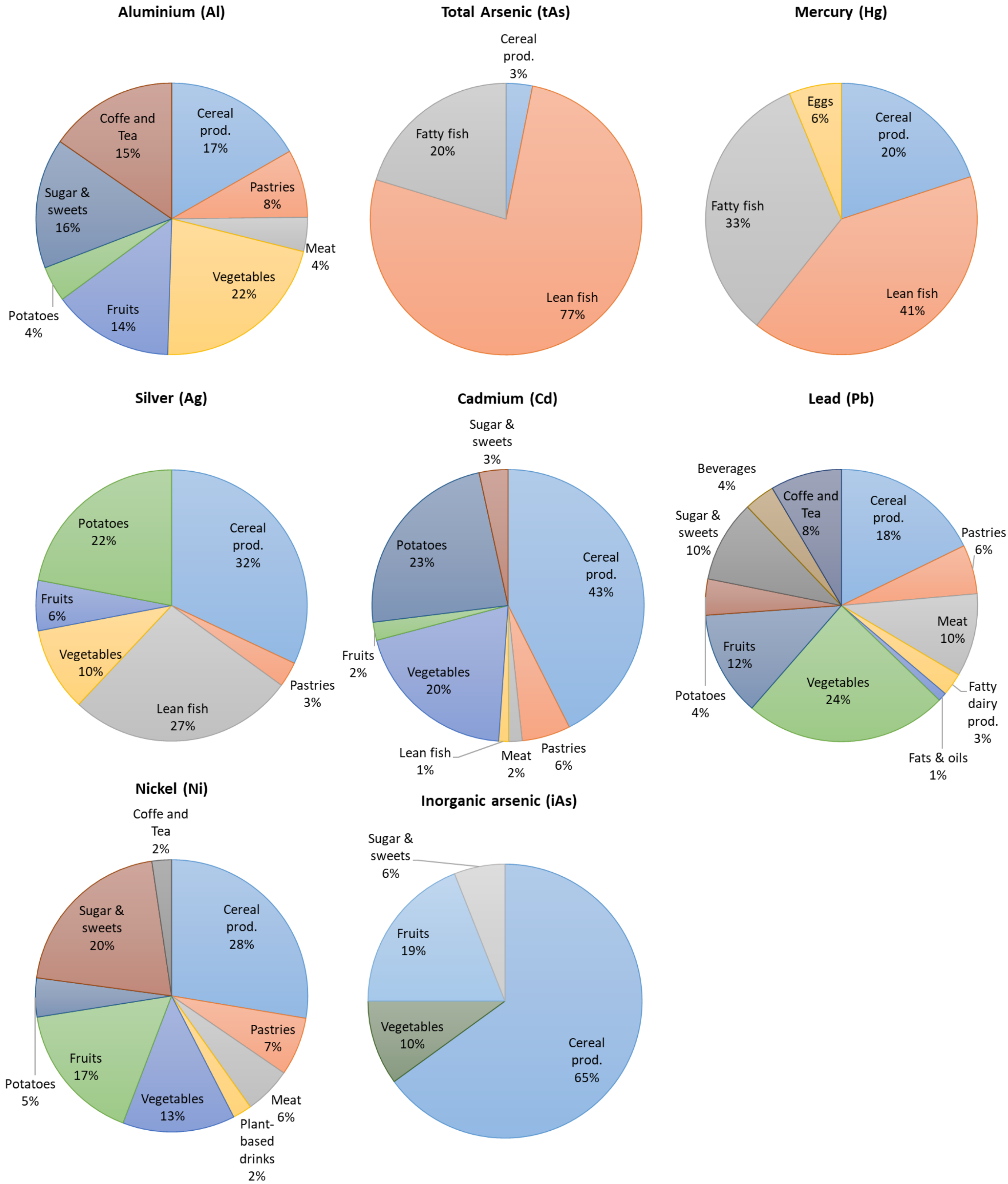

Figure 18 . Percentage contribution to the per capita intake of metals (Al, tAs, iAS Hg, Ag, Cd, Pb and Ni) from different food groups in the Market Basket 2022.

Food groups contributing less than 1% to the intake are not included in the pie charts. The percentage is based on mean per capita intake per food group. Hybrid bound was used when calculating means (i.e., medium bound concentration [0.5*limit of quantification, LOQ] was imputed for non-detects, with exception for when all three samples in one food group had concentrations below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculating mean).

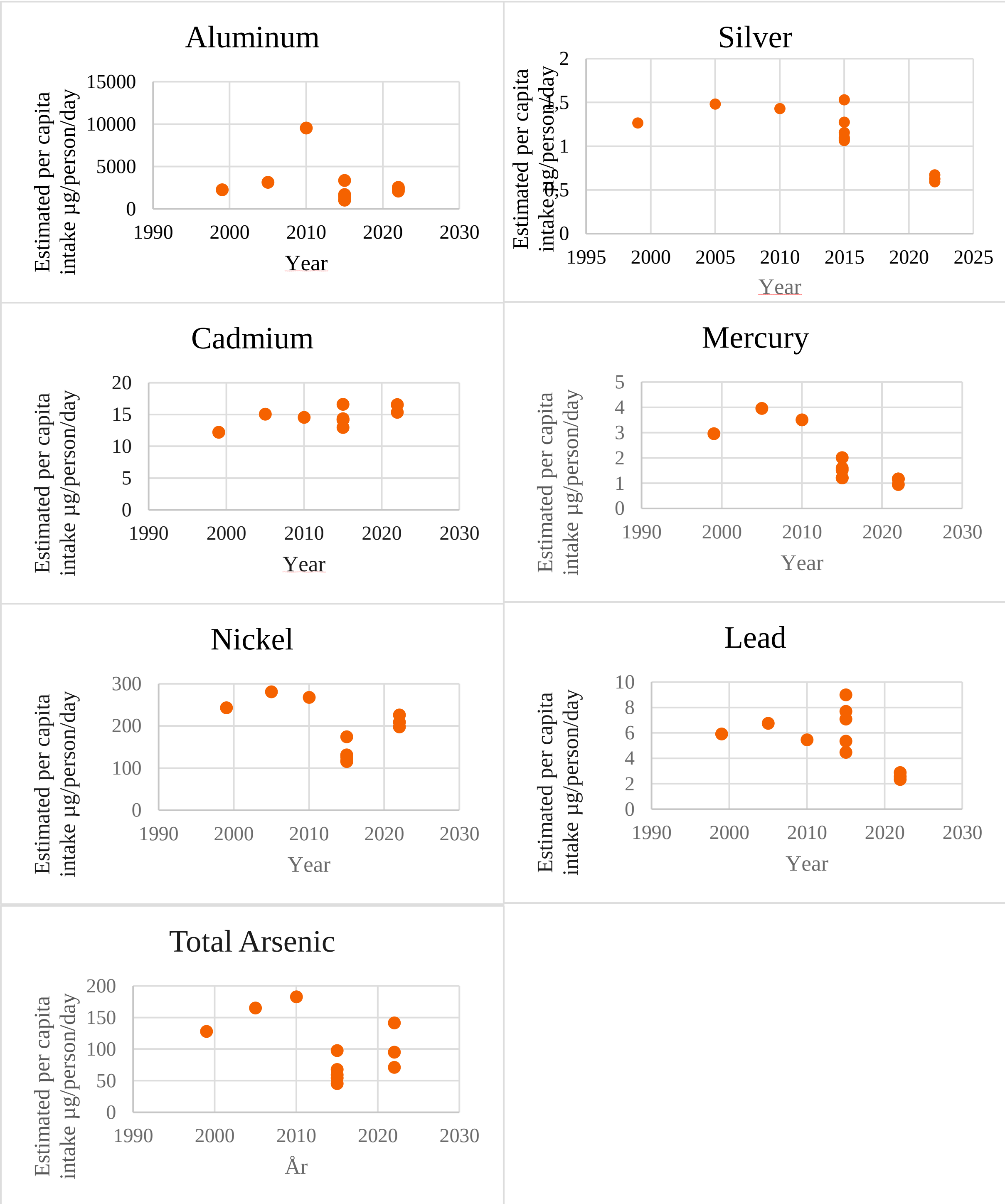

Figure 19 Estimated per capita intake of metals in market basket studies over time.
Note, that the per capita intake is a function of per capita consumption and compound concentrations in the food groups. Intake from coffee and tea is not included. Number of samples per food group was: N=1 (1999), N=1 (2005), N=1 (2010), N=5 (2015), N=3 (2022). Concentrations were analysed in one pooled sample per food group and market basket study. It is possible that loss of water content and other factors have affected the analysed concentrations of these samples, which must be kept in mind when interpreting these time trends. No statistical testing of time trends was done due to the low number of observations.

8.5.3 Risk assessments

The risk assessment and characterization is mainly a comparison of exposure levels in relation to health-based guidance values (HBGV) (Figure 20). Some of the HBGVs are tolerable weekly intakes (TWIs) such as for aluminium, cadmium and mercury, others are reference points like for lead and arsenic. It should be noted that there are many variations of important variables that affect the exposure and the risk across the population that are not taken into account, such as differences in body weight, consumption patterns and differences in concentrations *within* the food groups. This exposure estimate is only for an average consumer.

Arsenic (As)

We are exposed to arsenic in both organic and inorganic forms. The inorganic form (iAs) mainly occurs as trivalent (arsenite) and pentavalent (arsenate). Water, cereals, and rice primarily contain the inorganic arsenic, which is the most toxic form for humans. Other foods, mainly fish and shellfish, may contain high levels of the organic forms, such as arsenobetaine and arsenic sugar compounds, which, are considered to be less toxic (Swedish Food Agency and Sand, 2022).

EFSA has established a reference point for inorganic arsenic of 0.06 µg iAs/kg/day based on a 5% increased relative risk of skin cancer. The reference point should also be protective against bladder cancer, lung cancer, spontaneous abortion, stillbirth, infant mortality, and effects on the developing nervous system (EFSA et al., 2024).

The calculated intake of inorganic arsenic was 0.047 µg/kg bw/ day. This is close to the EFSA reference point of 0.06 µg iAs/kg/day. In the most recent EFSA opinion, MOEs for adult average and high consumer exposures range between 2-0.4 and between 0.86-0.18, respectively, indicating that this raises a concern for skin cancer.

Aluminium (Al)

Aluminium is neurotoxic in patients undergoing dialysis. These patients are chronically exposed to high levels of aluminium. In 2008, EFSA established a TWI of 1 mg/kg bw/week based on effects on the developing nervous system (EFSA, 2008). The present calculated intake of aluminium was 0.2 mg/kg bw/week. This represents 20% of the TWI.

Silver (Ag)

Pigmentation of the eye is considered to be the first sign of generalized argyria, in which the skin turns a bluish grey color. WHO (World Health Organization, 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) based on argyria. This translates to a daily exposure to 0.4 mg/day (for 70 years). The present calculated intake of silver was 0.66 µg/person/ day. This corresponds to 0.17% of the NOAEL. Cereals were the main contributor, accounting for about 30% of the exposure. This exposure is well below the NOAEL, and the health concern can be considered very low.

Cadmium (Cd)

Cadmium is toxic to the kidney, where it accumulates over time and may cause renal dysfunction. In addition, osteoporosis, cardiovascular effects, cancer, sperm motility and cognitive effects in children have been attributed to Cd exposure (Wallin et al., 2016, Borne et al., 2015), Engström et al., 2011, Satarug et al., 2017, (Larsson et al., 2015). EFSA established a TWI in 2009 based on effects on the kidney. A critical urinary concentration of 1 µg/g creatinine was converted to a TWI of 2.5 µg/kg bw based on 50 years of exposure.

The present calculated intake of cadmium was 1.6 µg/kg bw/week. This represents 64% of the TWI. The low margin to the TWI means it is likely that some consumers will exceed it. It would be desirable to lower exposure to cadmium.

Mercury (Hg)

Mercury occurs in different chemical forms, inorganic mercury, and methyl mercury, with different toxicological profiles. EFSA established a TWI of 1.3 µg/kg bw/week for methyl mercury and a TWI of 4 µg/kg bodyweight/week for inorganic mercury based on developmental effects on the brain(EFSA, 2012c).

The present calculated intake of mercury was 0.11 µg/kg bw/week corresponding to 8.4% of the TWI for methyl mercury. To estimate the exposure to methyl mercury more exactly, only exposure from fish and eggs was considered. A 1:1 conversion of mercury to methylmercury was assumed for these categories similar to what was done in the EFSA opinion. All other categories were regarded as inorganic mercury. This gives an exposure of 0.087 µg/kg bw/week or 6.7% of the TWI for methyl mercury. Most consumers are likely to be well under the TWI. This is also supported by biomonitoring data from (Swedish Food Agency and Swedish Environmental Protection Agency, 2020), where a median blood level of 0.72 µg/l was seen. When comparing this to the blood mercury concentration equivalent of the TWI, which is 23 µg/l, the average blood mercury level was found to be 3.1% of this threshold.

This estimate applies to the average consumer only. It cannot be ruled out that certain consumers eating a high amount of certain fish species have a different risk profile.

If the remaining mercury, mainly from cereals, is considered inorganic mercury this gives an exposure of 0.022 µg/kg bw/week. This corresponds to 0.54% of the TWI for inorganic mercury.

Nickel (Ni)

A TDI of 13 µg/kg bw based on an increased incidence of post-implantation loss in rat was determined by EFSA. They also note that persons that are nickel-sensitized may develop eczematous flare-up reactions in the skin from oral exposure (EFSA Panel on Contaminants in the Food Chain (CONTAM) et al., 2020). This is an acute effect and the LOAEL of 4.3 µg Ni/kg bw was selected as the reference point.

The present calculated intake of nickel was 3 µg/kg bw/ day. This represents 23% of the TDI or 69% of the reference point (RP) set for acute effects on nickel-sensitized individuals. The RP or 4.3 µg Ni/kg bw, translates to 301 µg Ni/day for a 70 kg person. This level of exposure could be achieved by drinking vegan drinks alone. A nickel sensitized individual only needs to drink less than 3 dl of such drinks (all other consumption held constant) in order to exceed the acute reference dose. The fraction of nickel sensitized individuals in Sweden is low compared to other European countries due to legislation implemented in 1990. However, prevalence is still around 8% (Schuttelaar et al., 2018).

Lead (Pb)

EFSA have established a RP for adults of 0.63 µg/kg bw/day for chronic kidney disease, and a RP of 1.5 µg/kg bw/day for effects on systolic blood pressure (EFSA, 2010). For children, EFSA has determined a RP of 0.5 µg/kg bw/day based on neurotoxic effects. These reference points are based on blood lead levels of 15 µg/l, 36 µg/l, and 12 µg/l, respectively. While EFSA concludes that there is no evidence for a threshold for critical lead-induced effects, they consider that exposures below the RP are associated with a low risk for reduced intelligence quotient (IQ) levels in young children and for high blood pressure in adults.

The present calculated intake of lead was 0.036 µg/kg bw/ day. This represents 5.4% of RP for adults. This was lower than the previous market basket survey. There is a trend toward lower levels lead in blood since leaded gasoline was phased out (Stajnko et al., 2024). However, blood levels are still close to the RP. In the recent Riksmaten survey median blood lead levels among adolescents were 7.1 µg/l and 16.32 µg/l in the 95th percentile so a reduction in lead exposure is still desirable (Swedish Food Agency and Swedish Environmental Protection Agency, 2020).

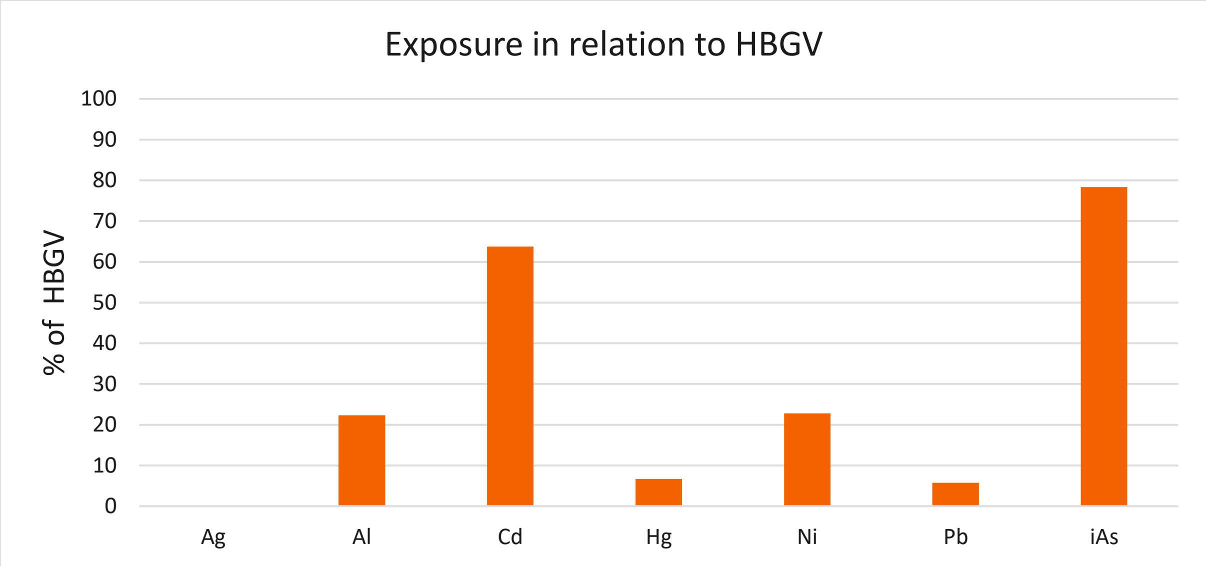

Figure 20. Estimated per capita intake in the Market Basket 2022 in relation to health-based guidance values (HBVG). For lead the reference point for adults, of 0.63 µg/kg bw/day for chronic kidney disease is used. For mercury the exposure is calculated from methyl mercury estimation and the TWI of 1.3 µg/kg bw/day is used.

8.5.4 Conclusion

Analytical sensitivity did not significantly impact the total exposure levels. There was very little difference between the upper, lower and hybrid bound estimates.

Exposure calculations of all of the metals were below the HBGVs. Some were, however, close, mainly for cadmium and inorganic arsenic. These compounds continue to be a cause for concern. Inorganic arsenic was much closer to the HBGV in this market basket than in the Market Basket 2015. This is mainly due to the updated reference point for arsenic, which is established more in line with what is considered an acceptable cancer incidence. The effect is also partly due to increased exposure.

New food groups in this market basket study are meat substitutes, and plant-based drinks. Interestingly, meat substitutes had the highest level of aluminium and lead. And plant-based drinks had a high level of nickel. Currently they do not contribute much to the overall exposure since they only comprise a small part of the total consumption. For certain individuals however these products might contribute significantly to exposure. In addition, if these products become more popular in the future this might become more significant.

8.6 PCBs and dioxins

Polychlorinated biphenyls (PCBs) are industrial chemicals that used to have multiple areas of use while dioxins, i.e. polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs), are formed as by-products during different industrial processes and incomplete combustion (Erickson and Kaley, 2011, Rappe, 1996). Although the production, use and/or emission of PCBs and dioxins have been strongly regulated since the 1970s they are still found in the environment and in humans due to their persistence to degradation. Food is the main source of human exposure to PCBs and dioxins. Because of their lipid solubility and persistence, they bioaccumulate throughout the food webs and food of animal origin contain the highest levels.

In the Market Basket 2022, PCBs and PCDD/Fs were analysed in seven selected food groups that are known to contribute most to exposure, i.e. meat, lean and fatty fish, lean and fatty dairy products, eggs, and fats/oils. In addition, the compounds were analysed in meat substitutes and plant-based drinks since these food groups were not included in previous market baskets and levels of PCBs and PCDD/Fs in these products on the Swedish market are mainly unknown.

The chemical analyses were performed at the Swedish Food Agency, and the analytical method is described in Appendix 4 (section A4.5). Briefly, PCDD/Fs and PCBs were extracted using either liquid-liquid-extraction or pressurized liquid extraction with different solvent mixtures depending on sample type. Clean-up and fractionation were performed before final determination using GC-HRMS with isotopic dilution technique. Six non dioxin-like (ndl) PCBs (CB 28, 52, 101, 138, 153, 180), the 12 dioxin-like (dl) PCBs (CB 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189) and the 17 toxic 2,3,7,8-chloro-substituted PCDD/Fs were determined. The LOQ varied between food groups and samples and was determined for the individual congeners in each sample. On fresh weight basis, LOQs for ndl-PCBs varied between 0.00001 and 0.05 ng/g, between 0.0003 and 23 pg/g for dl-PCBs and between 0.0001 and 0.86 pg/g for PCDD/F congeners.

8.6.1 Concentrations in food groups

Concentrations of all analysed PCBs and PCDD/Fs in all food groups and samples are presented in Appendix 5 (section A5.3) and the results are summarized and compiled in **Table 20** and **Table 21**. For the ndl-PCBs, concentrations of CB 153 and the sum of indicator PCBs, i.e. CB 28, 52, 101, 138, 153 and 180, are presented (Table 20). The sums of dl-PCB and PCDD/F concentrations are expressed as toxic equivalents (TEQ) using the toxicity equivalency factors (TEFs) set by WHO in 2005 (Van den Berg et al., 2006) (TEQ_{2005}, Table 20) and 2022 (DeVito et al., 2024) (TEQ_{2022}, Table 21). In the calculations of the sum of indicator PCBs and the TEQs, concentrations below LOQ were either set to zero (lower bound, LB), to LOQ divided by 2 (medium bound, MB) or to LOQ (upper bound, UB).

Concentrations of both indicator PCBs, dl-PCB TEQ_{2005} and PCDD/F TEQ_{2005} were highest in fatty fish, followed by fats/oils and fatty dairy products. The concentrations were lower in eggs, lean fish and meat and generally lowest in meat substitutes, lean dairy products, and plant-based drinks. The contribution of dl-PCB TEQs and PCDD/F TEQs to the total-TEQ_{2005} (sum of dl-PCB TEQ_{2005} and PCDD/F TEQ_{2005}) varied between food groups. In meat, lean fish, fatty fish and lean dairy products, dl-PCB TEQ_{2005} contributed with ca 60-70% to the total-TEQ_{2005}, while PCDD/F TEQ_{2005} dominated in fatty dairy products and fats/oils. In eggs, dl-PCB TEQ_{2005} and PCDD/F TEQ_{2005} contributed with about 50% each.

The WHO TEFs from 2022 have not been fully implemented yet. For example, current maximum levels established by the EU and the tolerable weekly intake (TWI) determined by EFSA are based on TEFs from 2005. The TEQ_{2022}-concentrations in Table 21 are accordingly presented mostly for comparison and for future use. The total-TEQ concentrations are lower when the 2005 TEFs are replaced by the 2022 TEFs, mainly because of lower TEFs of the dl-PCBs, leading to lower dl-PCB TEQs. Levels of dl-PCB TEQ_{2022} and PCDD/F TEQ_{2022} were highest in fatty fish, fatty dairy products and fats/oils. In fatty fish and lean dairy products, dl-PCB TEQ_{2022} contributed with more than 50% to the total-TEQ_{2022}. PCDD/F TEQ_{2022} dominated in the other food groups, contributing with more than 80% to the total-TEQ_{2022} in fatty dairy products and fats/oils and with ca 50-70% in meat, lean fish and eggs.

Table 20. Concentrations of PCBs and dioxins (PCDD/F) (fresh-weight basis) in food groups in the Market Basket 2022 (N=3 per food group). Sums (indicator-PCB, dl-PCB-TEQ_{2005}, PCDD/F-TEQ_{2005} and total-TEQ_{2005}) were calculated using the medium (MB), lower (LB) and upper (UB) bound methods. Mean, min, median and max are given for the medium bound approach, with lower and upper bound in parenthesis. The TEFs set by WHO in 2005 (Van den Berg et al., 2006) were used to calculate TEQ (TEQ_{2005}).

		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
Fat (%)	Mean	6.7	1.7	11	5.8	1.6	22	2.1	8.1	60
	Min	5.0	1.5	11	4.2	1.5	21	1.9	7.6	60
	Median	6.9	1.6	11	6.4	1.6	22	2.1	8.2	60
	Max	8.0	2.1	12	6.8	1.6	22	2.3	8.5	61
CB 153 (ng/kg)	Mean	30	39	857	0	3	53	0	44	43
	Min	26	27	660	<3	3	43	<0.2	37	27
	Median	32	44	860	<5	3	54	<0.3	42	49
	Max	33	45	1050	<10	4	61	<0.4	53	52
indicator-PCB[1] (ng/kg)	Mean	70 (63-76)	105 (90-114)	2383 (2383-2383)	23 (10-35)	7.3 (6.7-7.7)	133 (115-150)	1.2 (0-2)	97 (87-107)	143 (106-183)
	Min	64 (56-71)	65 (49-81)	1870 (1870-1870)	12 (1-23)	6 (6-7)	110 (96-130)	0.6 (0-1)	84 (74-94)	110 (80-140)
	Median	72 (65-79)	120 (100-130)	2350 (2350-2350)	21 (8-34)	7 (6-7)	140 (120-150)	1 (0-2)	87 (76-97)	150 (110-200)
	Max	73 (67-79)	130 (120-130)	2930 (2930-2930)	35 (20-49)	9 (8-9)	150 (130-170)	2 (0-3)	120 (110-130)	170 (130-210)
dl-PCB-TEQ_{2005}[2] (pg TEQ/kg)	Mean	13 (12.7-12.7)	15 (15.0-15.3)	230 (230-230)	1 (0.0-2)	2.3 (2.3-2.3)	37 (37.3-37.3)	0.3 (0.0-0.8)	18 (18.3-18.3)	28 (27-28)
	Min	11 (11-11)	10 (10-10)	180 (180-180)	1 (0-2)	2 (2-2)	35 (35-35)	0.3 (0.0-0.6)	14 (14-14)	20 (20-21)
	Median	13 (13-13)	17 (17-18)	220 (220-220)	1 (0-2)	2 (2-2)	38 (37-38)	0.3 (0.0-0.7)	14 (14-14)	28 (27-28)
	Max	14 (14-14)	18 (18-18)	290 (290-290)	1 (0.0-2)	3 (3-3)	39 (39-39)	0.4 (0.0-1)	27 (27-27)	36 (35-36)
PCDD/F-TEQ_{2005}[3] (pg TEQ/kg)	Mean	10 (4-17)	9 (2-16)	107 (85-133)	9 (2-16)	1.0 (0.2-2.3)	70 (61-82)	1.0 (0.0-2.3)	19 (14-23)	84 (62-105)
	Min	9 (0-15)	7 (1-14)	100 (80-120)	7 (0.4-14)	1 (0.0-2)	29 (10-49)	1 (0.0-2)	14 (10-18)	42 (18-66)
	Median	10 (5-16)	9 (1-17)	100 (83-130)	10 (2-15)	1 (0.2-2)	71 (64-77)	1 (0.0-2)	17 (14-19)	81 (57-110)
	Max	11 (7-19)	11 (4-18)	120 (93-150)	11 (5-19)	1 (0.5-3)	110 (110-120)	1 (0.0-3)	25 (19-31)	130 (110-140)
total-TEQ_{2005}[4] (pg TEQ/kg)	Mean	23 (17-29)	24 (17-32)	340 (320-363)	10 (2-18)	3.7 (3-4.7)	109 (96-119)	1.7 (0.0-3)	37 (33-41)	114 (90-132)
	Min	22 (13-26)	17 (11-24)	290 (270-310)	8 (0.4-15)	3 (3-4)	68 (49-88)	1 (0.0-3)	31 (28-33)	63 (38-87)
	Median	22 (18-30)	27 (19-35)	320 (300-340)	11 (2-17)	4 (3-5)	110 (99-110)	2 (0.0-3)	39 (33-45)	120 (93-140)
	Max	24 (19-32)	28 (21-36)	410 (390-440)	12 (5-22)	4 (3-5)	150 (140-160)	2 (0.0-3)	41 (37-46)	160 (140-170)

[1]sum of six non dioxin-like PCB congeners, i.e. indicator-PCB (CB 28, 52, 101, 138, 153 and 180).

[2]sum TEQ of 12 dioxin-like PCB congeners (CB 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189).

[3]sum TEQ of 17 PCDD/F congeners.

[4]sum TEQ of 17 PCDD/F and 12 dioxin-like PCB congeners.

Table 21. Concentrations of dl-PCBs and dioxins (PCDD/F) (fresh-weight basis) in food groups in the Market Basket 2022 (N=3 per food group). Sums (dl-PCB-TEQ_{2022}, PCDD/F-TEQ_{2022} and Total-TEQ_{2022}) were calculated using the medium (MB), lower (LB) and upper (UB) bound methods. Mean, min, median and max are given for the MB approach, with LB and UB in parenthesis. The TEFs set by WHO in 2022 (DeVito et al., 2024) were used to calculate TEQ (TEQ_{2022}).

		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
dl-PCB-TEQ_{2022}[1] (pg TEQ/kg)	Mean	6.4 (6.3-6.6)	7.8 (7.8-7.9)	122 (122-122)	0.6 (0.0-1.1)	1.2 (1.2-1.2)	19 (19-19)	0.2 (0.0-0.4)	9.4 (9.2-9.6)	14 (13-15)
	Min	5 (5-6)	5 (5-5)	96 (96-96)	0.4 (0-1)	1 (1-1)	18 (18-18)	0.2 (0.0-0.3)	7 (7-7)	11 (10-11)
	Median	7 (7-7)	9 (9-9)	116 (116-116)	0.6 (0-1)	1 (1-1)	19 (19-19)	0.2 (0.0-0.4)	7 (7-7)	14 (13-15)
	Max	7 (7-7)	9 (9-9)	155 (155-155)	0.7 (0.0-1)	1 (1-1)	20 (20-20)	0.3 (0.0-0.5)	14 (14-14)	18 (17-19)
PCDD/F-TEQ_{2022}[2] (pg TEQ/kg)	Mean	11 (5-17)	8.8 (2.5-15)	81 (62-100)	8.5 (2.5-15)	0.9 (0.1-1.7)	80 (70-89)	1.1 (0.0-2.2)	19 (16-22)	90 (69-110)
	Min	9 (0.0-16)	7 (2-13)	74 (57-90)	8 (0.3-13)	1 (0.0-2)	32 (13-50)	1 (0.0-2)	14 (11-16)	35 (12-57)
	Median	11 (5-17)	9 (3-15)	84 (65-102)	9 (1-15)	1 (0.1-2)	87 (83-91)	1 (0.0-2)	14 (11-17)	115 (94-136)
	Max	13 (9-18)	10 (3-17)	87 (66-108)	9 (6-16)	1 (0.2-2)	121 (115-127)	1 (0.1-3)	28 (25-31)	119 (101-137)
total-TEQ_{2022}[3] (pg TEQ/kg)	Mean	17 (11-24)	17 (10-23)	204 (185-223)	9.1 (2.5-16)	2.1 (1.3-2.9)	99 (89-109)	1.3 (0.0-2.6)	28 (25-31)	104 (83-125)
	Min	16 (7-23)	13 (7-18)	180 (162-198)	8 (0.3-14)	2 (1-3)	51 (33-70)	1 (0.0-2)	21 (18-24)	45 (22-69)
	Median	18 (12-23)	18 (12-25)	190 (173-207)	9 (1-16)	2 (1-3)	105 (100-109)	1 (0.0-3)	28 (24-31)	133 (111-152)
	Max	19 (14-25)	19 (12-26)	241 (219-263)	10 (6-17)	2 (1-3)	140 (134-147)	2 (0.1-3)	35 (32-39)	133 (115-155)

[1]sum TEQ of 12 dioxin-like PCB congeners (CB 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189).

[2]sum TEQ of 17 PCDD/F congeners.

[3]sum TEQ of 17 PCDD/F and 12 dioxin-like PCB congeners.

8.6.2 Exposure estimations and time trends

Estimated mean intakes of CB 153, total-TEQ_{2005} and total-TEQ_{2022} in the Swedish population (per capita intakes) are presented in Table 22 and the contribution of each food group to the per capita intakes of CB 153 and total-TEQ_{2005} are presented in Figure 21.

Table 22. Mean daily intake of CB 153 (ng/day), total-TEQ_{2005} and total-TEQ_{2022} (pg TEQ/day) from different food groups and total intake in the Market Basket 2022 (N=3 per food group). For the total intake from all food groups, min and max is presented (in parenthesis) in addition to the mean.

Food group	Per capita consumption (g/day)		Per capita intake CB 153 (ng/day)	total-TEQ_{2005} (pg TEQ_{2005}/day)	total-TEQ_{2022} (pg TEQ_{2022}/day)
Meat	194	LB		3.2	2.1
		MB	5.9	4.4	3.3
		UB		5.7	4.6
Lean fish	15	LB		0.3	0.2
		MB	0.6	0.4	0.2
		UB		0.5	0.3
Fatty fish	18	LB		5.8	3.3
		MB	15	6.1	3.7
		UB		6.5	4.0
Meat substitutes	3	LB	0	0.01	0.01
		MB	0.01	0.03	0.03
		UB	0.02	0.05	0.05
Lean dairy products	248	LB		0.7	0.3
		MB	0.8	0.9	0.5
		UB		1.2	0.7
Fatty dairy products	70	LB		6.7	6.2
		MB	3.7	7.7	6.9
		UB		8.4	7.6
Plant-based drinks	13	LB	0	0.0001	0.001
		MB	0.002	0.02	0.02
		UB	0.004	0.04	0.03
Eggs	29	LB		0.9	0.7
		MB	1.3	1.1	0.8
		UB		1.2	0.9
Fats and oils	55	LB		5.0	4.6
		MB	2.3	6.3	5.7
		UB		7.3	6.9
Total		**LB**	**30 (27-33)**	**23 (17-27)**	**17 (10-24)**
		MB	**30 (27-33)**	**27 (21-31)**	**21 (15-27)**
		UB	**30 (27-33)**	**31 (26-35)**	**25 (19-30)**

LB, lower bound (i.e. 0 is used for <LOQ); MB, medium bound (i.e. 0.5*LOQ is used for <LOQ); UB, upper bound (i.e. LOQ is used for <LOQ).

Most samples had concentrations of CB 153 above LOQ, giving identical LB, MB and UB per capita total intakes (Table 22). For PCDD/Fs and dl-PCBs, there were congeners with a large proportion of concentrations below LOQ, and the UB total-TEQ_{2005} per capita intake was 35% higher than the LB intake. The total per capita intake of CB 153 and total-TEQ_{2005} varied about 20 and 50%, respectively between the three grocery chains.

Fatty fish contributed to about half of the total intake of CB 153, with meat and fatty dairy products as second most important food groups (Figure 21). Fish was important also for the total-TEQ_{2005} intake, but in this case, the contributions from fatty fish, fatty dairy products and fats/oils were similar (23-28%) and meat was on the fourth place with a contribution of 16%. Using the 2022 TEFs, the contribution from fatty fish decreased to 17% and the contribution from fatty dairy products and fats/oils increased slightly.

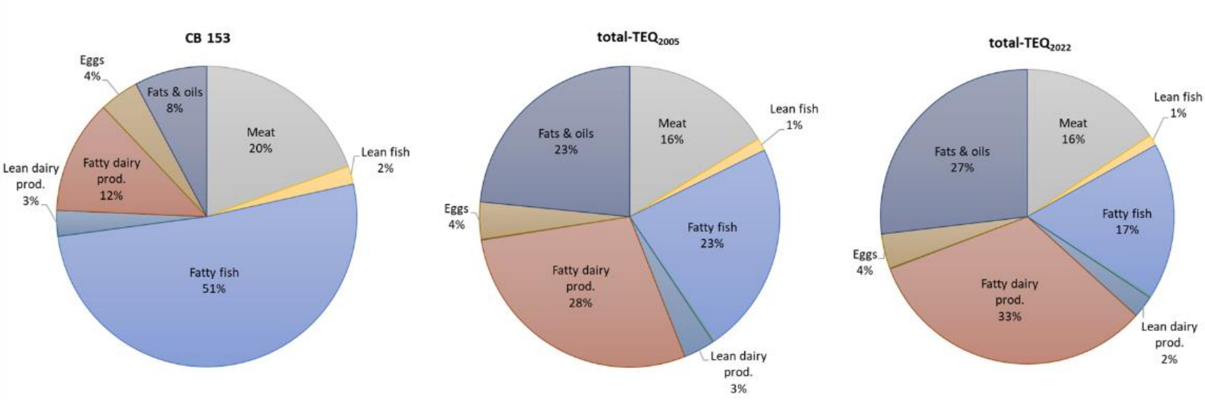

Figure 21. Percentage contribution to the per capita intake of CB 153, total-TEQ_{2005} and total-TEQ_{2022} (sum of dl-PCB TEQ and PCDD/F TEQ) from food groups in the Market Basket 2022.
Food groups contributing less than 1% (plant-based drinks and meat substitutes) are only presented graphically in the pie chart, and not with text. The percentages are based on mean per capita intake per food group. When calculating the mean, medium bound (MB) concentrations (0.5*LOQ) were imputed for concentrations below LOQ.

The contribution of different food groups to the total-TEQ_{2005} intake differed between the Market Basket 2015 (Swedish Food Agency, 2017) and 2022. The contribution from fish and eggs has decreased considerably, from 41 to 23% and from 18 to 4%, respectively. One explanation is decreased concentrations of dl-PCBs and PCDD/Fs in these food groups. The mean MB total-TEQ_{2005} concentration in fish was 296 pg TEQ/kg in 2015 and 198 pg TEQ/kg in 2022 (a fictive total fish food group with 55% fatty fish and 45% lean fish). Corresponding concentrations in eggs were 194 and 37 pg TEQ/kg. In addition, the estimated per capita consumption of fish in 2022 (33 g/day) was lower than in 2015 (46 g/day). Another data source for fish consumption was used in 2022 compared to previous market basket studies (see section 8.1). The fish consumption estimated in line with previous studies was 37 g/person/day. However, increasing the daily per capita fish consumption in the calculations to 37 g/day (20 g fatty fish and 17 g lean fish) only increased the contribution of fish to the total total-TEQ_{2005} intake to 26%. Because of the decreased intake from fish and eggs and because of slightly increased concentrations in fatty dairy products and fats/oils, the contribution from dairy products and fats/oils to the total total-TEQ_{2005} intake was higher in 2022 (31 and 23%) than in 2015 (17 and 12%). Both the per capita consumption of meat substitutes and plant-based drinks and the levels of CB 153 and total-TEQ in these food groups were low, and their contributions to the total per capita intakes were very small (<0.2%).

The estimated total per capita intakes were lower in the Market Basket 2022 than in 2015 for both CB 153 (mean 30 vs 55-56 ng/day) and total-TEQ_{2005} (23-31 vs 30-41 pg TEQ/day) (Swedish Food Agency, 2017). Statistical analyses (log-linear regression) of temporal trends including all previous market basket studies (1999, 2005, 2010, 2015) showed that the per-capita intake of CB 153 and total-TEQ_{2005} has decreased significantly with -5.9 and -3.8% per year, respectively during the period 1999 to 2022 (Figure 22). As a sensitivity analysis, the per capita fish consumption in line with previous studies (37 g/day) was used in the calculations of intake in Market Basket 2022. This only changed the time trend for CB 153 marginally to -5.7% per year and did not change the time trend for total-TEQ_{2005} at all. The decreasing trends agrees with data on PCBs and dioxins in mother's milk from Swedish first-time mothers, showing decreasing trends for CB 153 (-6% per year) and total-TEQ_{2005} (-5% per year) during the period 1996 to 2022 (Hedvall Kallerman et al., 2024).

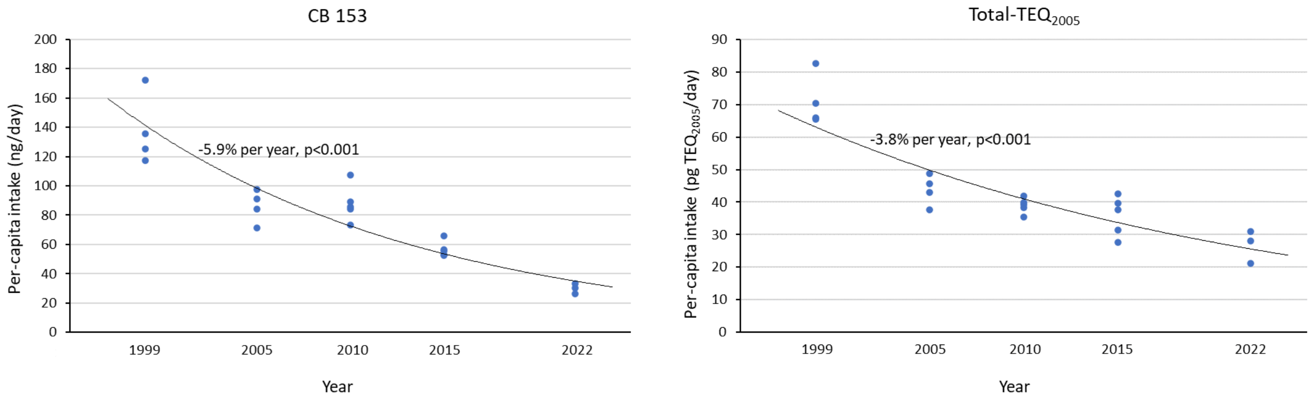

Figure 22. Temporal trends of MB per capita intake of CB 153 and total-TEQ_{2005} estimated from market basket studies in Sweden 1999-2022.
Note, that the per capita intake is a function of per capita consumption and concentrations in the food groups. Food groups included are meat, fish, dairy products, eggs and fats/oils. The lines represent regression lines from linear regression analyses with log (ln) transformed per capita intakes. Because of the log transformation, the regression coefficients give the percent change of per capita intake per year. Number of samples per food group was: N=4 (1999 and 2005; four different cities - Gothenburg, Sundsvall, Malmö, Uppsala; mean of two grocery chains per city in 2005), N=5 (2010; five different grocery chains in Uppsala; mean of normal and low price baskets from four of the chains and normal price from the fifth chain), N=5 (2015; five grocery chains in Uppsala) and N=3 (2022; three grocery chains in Uppsala).

8.6.3 Risk assessment

In a risk assessment performed by EFSA in 2005 it was concluded that the toxicological database on ndl-PCBs was too limited to allow for a decision on a tolerable intake (EFSA, 2005). However, the most sensitive effects in studies with individual ndl-PCB congeners in experimental animals were liver and thyroid toxicity. The NOAELs for these effects in studies with PCB 28, 128, and 153 were in the range of 30-40 µg/kg body weight per day. In addition to EFSA, WHO performed a risk assessment of ndl-PCBs in 2016 and also concluded that available toxicological data did not allow for a group evaluation or derivation of health-based guidance values (World Health Organization, 2016). However, to provide guidance on human health risks, the committee calculated margin of exposures (MOEs) for individual PCB congeners based on minimal effect doses from animal studies (changes in liver and thyroid histopathology). For CB 153, they used a minimal external effect dose of 7 µg/kg body weight per day. Comparing this with the results from the Market Basket 2022 (CB 153 intake 27-33 ng/day or 0.4-0.5 ng/kg body weight/day assuming a body weight of 70 kg) gives a MOE of 14,000 to 17,500.

In 2018, the EFSA panel on contaminants in the food chain established a tolerable weekly intake (TWI) for dl-PCBs and PCDD/Fs (total-TEQ_{2005}) of 2 pg TEQ_{2005}/kg body weight/week (EFSA, 2018). The TWI was based on effects on semen quality in 9-year-old boys following pre- and postnatal exposure and is protective for the general population and prevents women from reaching a concentration in blood that could cause pre- and postnatal effects. Assuming an average body weight in the Swedish population of 70 kg, the total MB intake of total-TEQ_{2005} based on the Market Basket 2022 (21-31 pg TEQ_{2005}/day, Table 22) corresponds to 2.1-3.1 pg TEQ_{2005}/kg body weight/week. This is at the same level or up to 50% higher than the TWI. Using the TEFs from 2022 and assuming a body weight of 70 kg, the total intake on body weight basis is 1.5-2.7 pg TEQ_{2022}/kg body weight/week. However, it is not possible to compare this intake with the current TWI since the TWI is based on TEFs from 2005 (EFSA, 2018).

8.6.4 Conclusion

Concentrations of CB 153, dl-PCB TEQ_{2005} and PCDD/F TEQ_{2005} were highest in fatty fish, followed by fats/oils and fatty dairy products. These food groups were also, together with meat, the largest contributors to the total intake of CB 153 and total-TEQ_{2005}. The estimated total per capita intake of CB 153 and total-TEQ_{2005} was lower in the Market Basket 2022 compared with 2015 and the intake decreased with 4-6% per year between 1999 and 2022. These results suggest positive effects of risk management efforts to reduce exposure from food. However, the estimated mean MB per capita intake of total-TEQ_{2005} is at the same level or exceeds the TWI established by EFSA, and a continued decrease in exposure from food is desirable.

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Appendices

Appendix 1. Food list describing foods in the Market Basket 2022

Appendix 2. Calculation of population mean body weight

Appendix 3. Overview of samples per compound and food group

Appendix 4. Description of chemical analytical methods used in the Market Basket 2022

Appendix 5. Concentrations of additional chemical compounds analysed in the Market Basket 2022

Appendix 1. Food list describing foods in the Market Basket 2022

The table describes included foods per food group, amount of each food per sample, waste applied, and statistical source of the foods and products included in the Market Basket Study 2022.

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Cereal products						
Fluor	2 products/sample	19	0	19	8	Nielsen IQ, online trades
Rice, polished	2 products/sample	17	0	17	7	Nielsen IQ, online trades
Rice, whole grain	1 product/sample	0.9	0	0.9	0.4	Online trades
Oats	1 product/sample	12	0	12	5	Nielsen IQ
Macaroni	2 products/sample	17	0	17	8	Nielsen IQ, online trades
Spaghetti	2 products/sample	10	0	10	5	Nielsen IQ, online trades
Muesli	2 products/sample	4	0	4	2	Nielsen IQ, GfK, online trades
Breakfast cereals	1 product/sample	2	0	2	0.9	Nielsen IQ
Cornflakes	1 product/sample	0.5	0	0.5	0.2	Nielsen IQ
Popcorn	1 product/sample	0.8	0	0.8	0.4	Online trades
Crisp bread	3 products/sample	9	0	9	4	Nielsen IQ, online trades
Soft bread, not the keyhole	3 products/sample	95	0	95	42	GfK
Soft bread, the keyhole	1 product/sample (2 batches/product)	41	0	41	18	GfK
Total		**226**		**226**	**100**	
Pastries						
Cookies	2 products/sample	9	0	9	17	Nielsen IQ, online trades
Crackers	2 products/sample (1-2 batches/product)	6	0	6	10	Nielsen IQ, online trades
Gingerbread	1 product/sample	3	0	3	5	Nielsen IQ
Cinnamon rolls and other doughy pastries	2 products/sample (1-2 batches/product)	15	0	15	27	Nielsen IQ, online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Pastries	2 products/sample (1-2 batches/product)	6	0	6	10	Nielsen IQ, online trades
Soft cakes like sponge cake	1 product/sample	6	0	6	10	Nielsen IQ
Pizza	2 products/sample	8	0	8	14	Nielsen IQ, online trades
Hand pie	1 product/sample (3 batches/product)	4	0	4	7	Nielsen IQ, online trades
Total		**55**		**55**	**100**	
Subgroup: pizza, hand pie						
Pizza	2 products/sample (3 batches/product)	8	0	8	67	Nielsen IQ, online trades
Hand pie	1 product/sample (3 batches/product)	4	0	4	33	Nielsen IQ, online trades
Total		**11**		**11**	**100**	
Meat						
Ground beef	Sweden (Ireland for 1 sample)	26	0	26	14	Available in store
Minute beef steak	Sweden	2	0	2	1	Available in store
Beef shank	Sweden	1	10	1	0.7	Available in store
Pork tenderloin	Denmark	4	0	4	2	Available in store
Pork loin	Sweden (70% without bones)	7	35	5	3	Available in store
Pork chop	Sweden (40% without bones)	4	25	4	2	Available in store
Pork flare fat	Sweden (Germany for 1 sample)	9	0	9	5	Available in store
Ground pork	Sweden	10	0	10	5	Available in store
Ground lamb	Sweden (Ireland for 1 sample)	3	0	3	2	Available in store
Whole chicken, with skin	Sweden	18	30	13	7	Nielsen IQ, online trades
Chicken breast	Sweden (2 batches/product)	37	0	37	19	Nielsen IQ, online trades
Moose shavings	Sweden (deer from New Zeeland for 1 sample)	6	0	6	3	Available in store
Chicken liver	Sweden or Denmark	2	0	2	0.8	Online trades
Cold cuts (ham and turkey)	2 products/sample	6	0	6	3	Nielsen IQ, online trades
Bacon	Sweden	4	0	4	2	Nielsen IQ
Smoked pork loin	Sweden or Germany	2	0	2	0.8	Nielsen IQ

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Bologna/salami	1 product/sample	4	0	4	2	Nielsen IQ, online trades
Hotdogs	1 product/sample	17	0	17	9	Nielsen IQ, online trades
Falu sausage	1 product/sample	13	0	13	7	Nielsen IQ, online trades
Liver paste	1 product/sample	3	0	3	2	Nielsen IQ, online trades
Sausage, canned	1 product/sample	2	40	1	0.7	Nielsen IQ, online trades
Meatballs and hamburgers, frozen	2 products/sample	10	0	10	5	Nielsen IQ, online trades
Dinner with meat (single serving), frozen	2 products/sample	12	0	12	6	Nielsen IQ, online trades
Total		**203**		**194**	**100**	
Subgroup: processed meat						
Cold cuts (ham and turkey)	2 products/sample	6	0	6	12	Nielsen IQ, online trades
Bacon	1 product/sample (2 batches/product)	4	0	4	8	Nielsen IQ
Smoked pork loin	1 product/sample	2	0	2	3	Nielsen IQ
Bologna/salami	1 product/sample (2-3 batches/product)	4	0	4	8	Nielsen IQ, online trades
Hotdogs	1 product/sample (2 batches/product)	17	0	17	35	Nielsen IQ, online trades
Falu sausage	1 product/sample (2 batches/product)	13	0	13	27	Nielsen IQ, online trades
Liver paste	1 product/sample	3	0	3	7	Nielsen IQ, online trades
Total		**48**		**48**	**100**	
Lean fish						
Cod, frozen	1 product/sample (2 batches/product)	4	0	4	26	Nielsen IQ
Pollock, frozen	1 product/sample	2	0	2	11	Nielsen IQ
Alaska pollock, frozen	1 product/sample	1	0	1	6	Nielsen IQ
Canned tuna in water	1 product/sample (2 batches/product)	1	0	1	9	Nielsen IQ, online trades
Fish sticks	1 product/sample	2	0	2	15	Online trades
Shrimp, North Sea, frozen	1 product/sample (2 batches/product)	4	0	4	23	Nielsen IQ
Shrimp, prepared or preserved	1 product/sample (2 batches/product)	2	0	2	11[4]	Nielsen IQ, online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Total		**15**		**15**	**100**	
Fatty fish						
Salmon, fresh	1 product/sample (2 batches/product)	4	0	4	25	Nielsen IQ, online trades
Salmon, frozen	1 product/sample (2 batches/product)	4	0	4	25	Nielsen IQ
Salmon, hot smoked	1 product/sample (1-2 batches/product)	1	0	1	6	Nielsen IQ, online trades
Salmon, cold smoked	1 product/sample	1	0	1	6	Nielsen IQ, online trades
Pickled herring	1 product/sample (2-7 batches/product)	5	0	5	28[5]	Nielsen IQ, online trades
Herring	1 product/sample	0.3	0	0.3	2	Available in store
Mackerel in tomato sauce	1 product/sample	1	0	1	6	Nielsen IQ
Caviar	1 product/sample	1	0	1	4	Nielsen IQ
Total		**17**		**17**	**100**	
Meat substitutes						
Tofu	1 product/sample (1-2 batches/product)	0.4	0	0.4	14	Nielsen IQ or own brand product
Vegetarian deli	1 product/sample	0.1	0	0.1	2	Nielsen IQ, online trades
Frozen soy mince	2 products/sample	0.5	0	0.5	18	Online trades
Pieces/fillets (soy protein)	1 product/sample	0.4	0	0.4	12	Online trades
Vegetarian sausage (soy, pea, and/or bean protein)	1 product/sample	0.2	0	0.2	5	Online trades
Vegetarian burger (wheat, soy, and/or pea protein)	1 product/sample	0.5	0	0.5	16	Online trades
Schnitzel/nuggets (wheat or soy protein)	1 product/sample	0.4	0	0.4	13	Online trades
Plant-based meatballs (mycoprotein, wheat, and/or soy protein)	1 product/sample	0.3	0	0.3	10	Online trades
Falafel	1 product/sample	0.3	0	0.3	10	Online trades
Total		**3**		**3**	**100**	
Lean dairy products						

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Milk 0.5% fat, conventional	2 products/sample	27	0	27	11	Nielsen IQ and own brand product
Milk 0.5% fat, organic	1 product/sample	6	0	6	2	Nielsen IQ or own brand product
Milk 1.5% fat, conventional	2 products/sample	74	0	74	30	Nielsen IQ and own brand product
Milk 1.5% fat, organic	1 product/sample	16	0	16	7	Nielsen IQ or own brand product
Milk 3% fat, conventional	2 products/sample	42	0	42	17	Nielsen IQ and own brand product
Milk 3% fat, organic	1 product/sample	9	0	9	4	Nielsen IQ or own brand product
Sour milk 0.5% fat, plain	1 product/sample	4	0	4	1	Nielsen IQ, online trades
Yogurt 0.5% fat, plain	1 product/sample	2	0	2	0.7	Online trades
Yoghurt <0.5% fat, flavoured	1 product/sample	4	0	4	2	Nielsen IQ, online trades
Sour milk 1.5% fat, pain	1 product/sample	6	0	6	2	Nielsen IQ or own brand product
Yoghurt 2% fat, plain	1 product/sample	3	0	3	1	Online trades
yoghurt 2% fat, flavoured	1 product/sample	7	0	7	3	Nielsen IQ, online trades
Sour milk 3% fat, plain	1 product/sample	18	0	18	7	Nielsen IQ, online trades
Yoghurt 3% fat, plain	1 product/sample	9	0	9	4	Online trades
Yoghurt 2% fat, flavoured	1 product/sample	21	0	21	8	Nielsen IQ, online trades
Total		**249**		**249**	**100**	
Fatty dairy products						
Cooking cream	1 product/sample	7	0	7	11[6]	Online trades
Sour cream	1 product/sample	0.5	0	0.5	0.7	Nielsen IQ
Cooking yoghurt	1 product/sample	0.6	0	0.6	0.9	Nielsen IQ
Whip cream (36-40% fat)	1 product/sample	9	0	9	13	Nielsen IQ
Hard cheese ”Hushållsost”	1 product/sample (2 batches/product)	17	0	17	24	Nielsen IQ
Hard cheese ”Prästost”	1 product/sample (2 batches/product)	12	0	12	17	Nielsen IQ

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Hard cheese ”Herrgårdsost”	1 product/sample	9	0	9	12	Nielsen IQ
Spreadable cheese	1 product/sample	3	0	3	4	Nielsen IQ
Halloumi	1 product/sample	3	0	3	5	Nielsen IQ or own brand product
Feta cheese	1 product/sample	1	0	1	2	Nielsen IQ, online trades
Dessert cheese	1 product/sample	2	0	2	3	Nielsen IQ, online trades
Cottage cheese	1 product/sample	6	0	6	8	Nielsen IQ
Total		**70**		**70**	**100**	
Plant-based drinks						
Yoghurt	2 products/sample	2	0	2	12	Nielsen IQ, online trades
Cream products	1 product/sample	1	0	1	8	Online trades
Oat milk	3 products/sample	9	0	9	64	Online trades
Almond milk	1 product/sample	0.9	0	0.9	7	Online trades
Soy milk	2 products/sample	1	0	1	8	Online trades
Total		**13**		**13**	**100**	
Eggs						
Eggs, free-range indoor	1 product/sample (5-6 batches/product)	28	12	24	84	Nielsen IQ
Eggs, organic	1 product/sample (2-3 batches/product)	5	12	5	16	Online trades
Total		**33**		**29**	**100**	
Fats and oils						
Butter 80% fat	1 product/sample	8	0	8	14	Nielsen IQ or own brand product
Baking and cooking fat in foil	2 products/sample	2	0	2	4	GfK
Table margarine butter/oil, 75% fat	1 product/sample	8	0	8	15	Online trades
Table margarine, mainly vegetable, 70-75% fat	1 product/sample	2	0	2	4	GfK
Liquid margarine (mixture of butter and oil)	1 product/sample	4	0	4	6	Online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Light margarine, approx. 40% fat	2 products/sample	11	0	11	20	Online trades
Cooking oil	1 product/sample	1	0	1	1	Online trades
Canola oil	2 products/sample	3	0	3	5	Online trades
Olive oil	2 products/sample	1	0	1	2	Online trades
Mayonnaise	1 product/sample (2 batches/product)	9	0	9	16	Nielsen IQ, online trades
Bearnaise/hollandaise sauce	1 product/sample	3	0	3	5	Nielsen IQ, online trades
Salad dressing	1 product/sample	4	0	4	8	Nielsen IQ, online trades
Total		**55**		**55**	**100**	
Vegetables						
Carrot, fresh	Sweden or Italy	23	5	22	9	Available in store
Carrot, fresh, organic	Sweden	4	5	4	2	Available in store
Beets, fresh	Sweden	4	17	4	1	Available in store
Cucumber, fresh	Sweden	17	8	16	6	Available in store
Yellow onion, fresh	Sweden or the Netherlands	25	6	24	10	Available in store
Leeks, fresh	Sweden or the Netherlands	2	8	2	0.8	Available in store
Cauliflower, fresh	Sweden	4	33	3	1	Available in store
Broccoli, fresh	Sweden or Spain	8	39	5	2	Available in store
Cabbage, fresh	Sweden	5	14	5	2	Available in store
Iceberg lettuce, fresh	Sweden	41	5	39	16	Available in store
Large tomatoes, fresh	The Netherlands	13	0	13	5	Available in store
Small tomatoes, fresh	The Netherlands, Morocco or Spain	13	0	13	5	Available in store
Mixed bell peppers, fresh	Yellow, red. The Netherlands or Spain	27	15	23	9	Available in store
Broccoli, frozen	1 product/sample	4	0	4	2	Online trades
Stir-fry vegetables, frozen	1 product/sample	4	0	4	1	Online trades
Peas, frozen	1 product/sample	3	0	3	1	Online trades
Mixed vegetables, frozen	1 product/sample	2	0	2	1	Online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Chopped spinach, frozen	1 product/sample	1	0	1	0.6	Online trades
Red lentils, dried	1 product/sample	1	0	1	0.5	Nielsen IQ
Pickled cucumber	1 product/sample	9	40	5	2	Nielsen IQ or own brand product
Crushed tomatoes	1 product/sample	23	0	23	9	Nielsen IQ or own brand product
Corn kernels, canned	1 product/sample	8	40	5	2	Nielsen IQ or own brand product
Olives, black	1 product/sample	3	40	2	0.6	Nielsen IQ, online trades
Olives, green	1 product/sample	3	40	2	0.6	Nielsen IQ, online trades
Ketchup	1 product/sample	20	0	20	8	Nielsen IQ, online trades
Total		**271**		**245**	**100**	
Fruits						
Oranges, fresh	South Africa	20	29	14	7	Available in store
Clementines etc, fresh	South Africa, Peru or Spain	20	25	15	7	Available in store
Grapes, red, fresh	Italy or Spain	3	4	3	1	Available in store
Grapes, green, fresh	Greece or Italy	3	4	3	1	Available in store
Mixed nuts, snacks	1 product/sample	7	0	7	3	Nielsen IQ, online trades
Walnuts, unsalted	1 product/sample	0.8	0	0.8	0.4	Online trades
Almonds, unsalted	1 product/sample	0.8	0	0.8	0.4	Online trades
Apples, fresh	France or Italy	27	8	25	12	Available in store
Pears, fresh	The Netherlands	6	8	5	3	Available in store
Peach/nectarine, fresh	Spain or Italy	5	24	4	2	Available in store
Plume, fresh	Italy, Sweden or Hungary	1	6	1	0.6	Available in store
Bananas, fresh	Ecuador or Colombia	29	37	18	8	Available in store
Bananas, organic, fresh	Ecuador or Dominican Republic	29	37	18	8	Available in store
Avocado, fresh	Kenya or Peru	8	32	5	2	Available in store
Kiwi, fresh	Chile or New Zeeland	5	15	4	2	Available in store

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Mango, fresh	Spain, Israel or Brazil	5	31	4	2	Available in store
Strawberries, fresh	Sweden	5	3	5	2	Available in store
Blueberries fresh	Argentine, Poland or Peru	2	2	2	1	Available in store
Raspberries, fresh	Poland or Portugal	2	0	2	1	Available in store
Strawberries, frozen	1 product/sample	1	0	1	0.5	Online trades
Blueberries, frozen	1 product/sample	0.5	0	0.5	0.2	Online trades
Raspberries, frozen	1 product/sample	2	0	2	1	Online trades
Raisins	1 product/sample	3	0	3	2	Nielsen IQ, online trades
Pineapple, canned	1 product/sample	6	40	4	2	Nielsen IQ, online trades
Fruit cocktail, canned	1 product/sample	1	40	0.7	0.3	Nielsen IQ, online trades
Peach, canned	1 product/sample	1	40	0.8	0.4	Nielsen IQ, online trades
Lingonberry jam	1 product/sample	8	0	8	4	Nielsen IQ, online trades
Strawberry jam	1 product/sample	3	0	3	2	Nielsen IQ, online trades
Apple purée	1 product/sample	3	0	3	1	Nielsen IQ, online trades
Juice, not concentrate	1 product/sample	16	0	16	7	Nielsen IQ, online trades
Juice, concentrate	1 product/sample	1	0	1	0.5	Nielsen IQ, online trades
Fruit/berry drink, not concentrate	1 product/sample	9	0	9	4	Nielsen IQ, online trades
Fruit/berry drink, concentrate	1 product/sample	5	0	5	2	Nielsen IQ, online trades
Fruit cordial, concentrate	2 products/sample	21	0	21	10	Nielsen IQ, online trades
Total		**260**		**215**	**100**	
Potatoes						
Potatoes, peeled, organic	Sweden	5	20	4	3	Online trades
Potatoes, unpeeled, organic	Sweden	5	0	5	4	Online trades
Potatoes, peeled, conventional	Sweden	58	20	46	33	Online trades
Potatoes, unpeeled, conventional	Sweden	58	0	58	41	Online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
French fries, frozen	1 product/sample	14	0	14	10	Nielsen IQ
Potato wedges, frozen	1 product/sample	9	0	9	7	Nielsen IQ
Potato chips	2 products/sample	6	0	6	4	Nielsen IQ, online trades
Total		**155**		**142**	**100**	
Sugar and sweets						
Granulated sugar	1 product/sample (2 batches/product)	12	0	12	17	Nielsen IQ or own brand product
Chocolate drink powder with sugar	1 product/sample	5	0	5	7	Nielsen IQ
Chocolate sauce for ice cream	1 product/sample	0.7	0	0.7	0.9	Online trades
Honey	1 product/sample	2	0	2	3	Nielsen IQ, online trades
Chocolate cookies	1 product/sample (2 batches/product)	7	0	7	9	Nielsen IQ or own brand product
Chocolate confectionery	1 product/sample (2-3 batches/product)	4	0	4	5	Nielsen IQ
Hazelnut spread	1 product/sample	9	0	9	12	Nielsen IQ
Sugar confectionery	2 products/sample (2-5 batches/product)	21	0	21	28	Nielsen IQ, online trades
Ice cream	1 product/sample	9	0	9	12	Nielsen IQ, online trades
Single-serving ice cream	1 product/sample (2 batches/product)	4	0	4	6	Nielsen IQ
Popsicle	1 product/sample	1	0	1	2	Online trades
Total		**74**		**74**	**100**	
Beverages						
Soda with sugar	2 products/sample (2 batches/product)	88	0	88	33	Nielsen IQ, online trades
Diet soda	2 products/sample	79	0	79	30	Nielsen IQ, online trades
Cider	1 product/sample	9	0	9	3	Oneline trades
Mineral water, flavoured	1 product/sample	31	0	31	12	Nielsen IQ, online trades
Non-carbonated fruit drink	1 product/sample	18	0	18	7	Nielsen IQ, online trades

Product, Food	No. products/batches[1]	Consumption (g/person/day), incl. waste	Waste (%)	Consumption (g/person/day, excl. waste[2]	% of sample	Source for choice of products[3]
Carbonated mineral water, plain	1 product/sample	4	0	4	2	Nielsen IQ
Still (non-carbonated) mineral water	1 product/sample	1	0	1	0.5	Nielsen IQ
Beer, <2.25% alcohol	1 product/sample	1	0	1	0.5	Nielsen IQ
Beer, non-alcoholic	1 product/sample	3	0	3	1	Nielsen IQ
Beer, 2.8% alcohol	2 products/sample	14	0	14	5	Nielsen IQ
Beer, 3.5% alcohol	2 products/sample	14	0	14	5	Nielsen IQ
Total		**262**		**262**	**100**	
Coffee and tea						
Coffee powder (medium roast and Arabic bean)	2 products/sample (3 batches/product)	316[7]	0	316[7]	78	Nielsen IQ, online trades
Black tea, loose tea	1 product/sample	36[8]	0	36[8]	9	Nielsen IQ, online trades
Black tea, bagged tea	1 product/sample	36[8]	0	36[8]	9	Nielsen IQ, online trades
Instant coffee	1 product/sample	19[7]	0	19[7]	5	Nielsen IQ, online trades
Total		**408**		**408**	**100**	

1 Product is defined as a food item with a specific brand. If one brand made up for more than 15% of a sample, several batches of that brand was included. Other brands can also have several batches even if they constitute ≤15% of a sample because a larger amount of the product was needed in the sample.
2 Corresponds to the per capita consumption used in the estimations of the per capita intake.
3 References: Nielsen IQ (2018): https://www.Nielsen IQ.com/ [accessed 05 June 2023]. Growth for Knowledge (GfK) (2021): *GfK Panel Sverige* https://panel.gfk.com/scan-se/hem?srcid=23185&gclid=EAIaIQobChMIl_-K2MyS_wIVHI1oCR1HQg0wEAAYASAAEgIKYfD_BwE [accessed 26 May 2023]. Online trades were mainly for ICA, Coop, and Willys. Combined sources are often used.
4 One sample contained slightly less shrimps than the other two samples (1.2 g instead of 1.6 g).
5 One sample contained less pickled herring than the other two samples (2.7 g instead of 4.9 g).
6 Two samples contained less cooking cream than one sample (6.2 g and 6.4 g instead of 7.4 g).
7 Consumption converted to ready-to-drink by multiplying the data from Swedish Board of Agriculture with 15.
8 Consumption converted to ready-to-drink by multiplying the data from Swedish Board of Agriculture with 100.

Appendix 2. Calculation of population mean body weight

Calculation of population mean body weight in Sweden when adjusting for weights in younger age groups are shown in Table A2.1. Population distribution is based on numbers derived from Statistics Sweden´s statistical database (Statistic´s Sweden, 2023) for population by age and sex in year 2022. Children mean weights are based on weight curves given in Nordic nutrition recommendations (Blomhoff et al., 2023). Adult mean weights are based on data from the Public Health Agency of Sweden´s survey “Hälsa på lika villkor 2022” (16 years or older) (Public Health Agency of Sweden, 2023) for adults 16 years or older.

Table A2.1. Estimation of population mean body weigh in Sweden when considering population distribution.

	Men			Women			
Age (yrs)	N	Proportion of population (%)	Mean weight (kg)	N	Proportion of population (%)	Mean weight (kg)	Contribution to population mean weight (kg)[1]
0	54 095	0.51	3.6	51 091	0.49	3.5	0.04
1	59 411	0.56	10.4	56 712	0.54	9.7	0.11
2	59 723	0.57	13.2	56 304	0.54	12.4	0.14
3	60 942	0.58	15.2	57 408	0.55	14.6	0.17
4	62 012	0.59	17.4	58 669	0.56	16.8	0.20
5	62 443	0.59	19.3	59 105	0.56	19	0.22
6	64 547	0.61	21.9	61 159	0.58	21.6	0.26
7	64 092	0.61	24.6	59 750	0.57	24	0.29
8	64 540	0.61	27.2	60 931	0.58	26.7	0.32
9	64 198	0.61	30.1	60 390	0.57	29.8	0.35
10	64 589	0.61	33.3	61 154	0.58	33.5	0.40
11	64 108	0.61	36.9	60 640	0.58	37.7	0.44
12	66 744	0.63	41.4	62 893	0.60	42.9	0.52
13	64 985	0.62	47	61 270	0.58	48	0.57
14	64 577	0.61	53.2	60 611	0.58	52.3	0.63
15	63 641	0.60	59.4	59 916	0.57	55.3	0.67
≥16	4 293 677	41	84.5	4 275 229	41	69.9	63
Sum							**68**

[1] Contribution to population mean weight for each age group was calculated by the following formula: $\%_{\text{men (age group)}}$*mean $\text{weight}_{\text{men (age group)}}$ + $\%_{\text{females (age group)}}$*mean $\text{weight}_{\text{females (age group)}}$

Appendix 3. Overview of samples per compound and food group

The table describes in which food groups each compound was analysed and the number of samples per food group and compound.

Chemical analysis	Cereal products	Pastries	Pizza, hand pie[1]	Meat	Processed meat[2]	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea	Total
Nutrients																				
Carotenoids	3	3						3	3	3	3	3	3	3	3	3	3			36
Essential minerals	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	57
Fatty acids	3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3			48
Fibres	3	3		3	3	3	3	3			3			3	3	3	3			36
Folate	3	3		3		3	3	3	3	3	3	3		3	3	3	3	3		45
Iodine	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	57
Macronutrients[3]	3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3[4]	3[5]	54
Mono-/disaccharides	3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		51
Retinols	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3		48
Riboflavin	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3		48
Thiamin	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3		48
Tocopherols	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3		48
Vitamin D	3	3		3		3	3	3	3	3	3	3	3				3			36
Vitamin K	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3			45
Water	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	57

Chemical analysis	Cereal products	Pastries	Pizza, hand pie[1]	Meat	Processed meat[2]	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages	Coffee and tea	Total
Contaminants/ unwanted substances																				
Acrylamide	3	3	3					3								3	3	3	3	24
BFR				3		3	3	3	3	3	3	3	3							27
Chlorinated paraffins[6]	1[6]	1[6]		1[6]		1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	1[6]	17
Metals	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	57
Inorganic arsenic	3					3	3	3			3			3	3		3		3	27
3-MCPD, glycidol	3	3			3	3	3	3			3		3			3	3			30
Mycotoxins	3														3					6
Organochlorinated pesticides				3		3	3	3	3	3	3	3	3							27
PAH	3	3		3	3	3	3	3			3		3	3	3		3		3	39
PCBs/dioxins				3		3	3	3	3	3	3	3	3							27
PFAS	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	51
PFR	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	51
Plasticizers	3	3		3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	51
Radionuclides	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19
Total	74	68	16	68	31	74	74	80	65	65	77	65	68	62	65	62	71	47	35	1167

BFR, brominated flame retardants; MCPD; PAH, polycyclic aromatic hydrocarbons; PFAS, poly- and perfluorinated alkyl substances; PFR, phosphorous flame retardants.

[1] Subgroup of Pastries.
[2] Subgroup of Meat.
[3] Ash, fat, nitrogen, starch.
[4] Only ash and starch.
[5] Only ash.
[6] A pooled sample was prepared for each food group. One third of each sample was mixed in the pool.

Appendix 4. Chemical analytical methods used in the Market Basket 2022

A4.1. Macronutrients

Table A4.1.1 presents the methods used for determining the content of macronutrients in the Market Basket 2022. Measurement uncertainty and LOQ are also shown. All analyses were performed at accredited laboratories.

Total fat was analysed by Eurofins Food & Feed Testing Sweden in Linköping, Sweden, using nuclear magnetic resonance spectroscopy (NMR).

Individual fatty acids were analysed at the Swedish Food Agency in Uppsala, Sweden. Fatty acids were determined by gas chromatography using a modified method by IUPAC 6th Ed, Part 1, 2.301 and 2.302, 1979. Methyl esters of fatty acids were produced from triglycerides by metanolysis in an alkaline environment. The percentage proportion of a mixture of methyl esters of fatty acids were determined by gas chromatography. Individual fatty acids were not analysed if total fat content was less than 0.5 g/100 g (i.e. the food group vegetables). The sums of the percentage proportion of fatty acid groups were calculated by the following formulas:

SFA =	(4:0 + 6:0 + 8:0 + 10:0 + 11:0 + 12:0 + 13:0 + 14:0 + 14:0iso + 15:0 + 15:0anteiso + 15:0iso + 16:0 + 16:0anteiso + 16:0iso + 17:0 + 17:0anteiso + 17:0iso + 18:0 + 18:0anteiso + 18:0iso + 20:0 + 22:0 + 23:0 + 24:0)
MUFA =	(10:1 + 12:1 + 14:1 + 15:1 + 16:1 + 17:1 + 18:1 + 20:1 + 22:1 + 24:1n-9)
PUFA =	(16:2n-4 + 16:3 + n- 3 PUFA + (n-6 PUFA – 18:2n-6 + 18:2))
n-3 PUFA =	(16:4n-3 + 18:3n-3 + 18:4n-3 + 20:3n-3 + 20:4n-3 + 20:5n-3 + 21:5n-3 + 22:4n-3 + 22:5n-3 + 22:6n-3)
n-6 PUFA =	(18:2n-6 + 18:3n-6 + 20:2n-6 + 20:3n-6 + 20:4n-6 + 22:2n-6 + 22:4n-6 + 22:5n-6)
TFA =	(14:1trans + 16:1trans + 18:1trans + 20:1trans + 18:2trans + 18:3n-3trans)

Starch was analysed by Eurofins Food & Feed Testing Norway using polarimetry.

Dietary fibres were analysed by Eurofins Food Testing Netherlands (Heerenveen) (EUNLHE) using enzymatic gravimetric-high-performance liquid chromatography (HPLC). The analysis includes both high and low molecular weight fibres as well as resistant starch. Total fibre content was calculated as the sum of high molecular weight (water-insoluble polysaccharides and water-soluble polysaccharides) and low molecular weight fibre (oligosaccharides).

Mono- and disaccharides were analysed by Eurofins Food & Feed Testing Sweden in Linköping, Sweden, using HPLC.

Water and ash contents were analysed by Eurofins Food & Feed Testing Sweden in Linköping, Sweden, using gravimetry.

Protein was analysed as nitrogen by Kjeldahl et al by Eurofins Food & Feed Testing Sweden in Linköping, Sweden. The standard nitrogen conversion factor of 6.25 (Regulation (EU) No 1169/2011) was used for calculating protein content.

Table A4.1.1. Chemical methods, measurement uncertainty and limit of quantifications (LOQs) used for determining the content of macronutrients in the Market Basket 2022.

Substance	Method	Laboratory	Measurement uncertainty	LOQ
Fat, total[1]	NMKL 160 mod.	EUSELI	±10%	1 g/kg
Fatty acids (FA)	GC-FID (SLV-m062-f.9)	Swedish Food Agency	±34% if FA ≤0.5% ±7% if FA >0.5-6% ±5% if FA >6% ±10% total trans FAs	0.1%
Nitrogen (Kjeldahl)[2]	NMKL 6:2003	EUSELI	±10%	0.5 g/kg
Fibre, total	AOAC 2009.01-M	EUNLHE		
High molecular weight fibers + resistant starch[3]	AOAC 2009.01 (HEC1A)	EUNLHE	±18.5%	4 g/kg
Low molecular weight fibers[3]	AOAC 2009.01 (HEC1A)	EUNLHE	±15.4-22.0%	2 g/kg
Starch[4,5]	In-house method (MJ010 and MJ011)	EUNOMO2	±15%	10 g/kg
Glucose	AOAC 982.14, mod.	EUSELI	±15-25%	0.4 g/kg
Fructose	AOAC 982.14, mod.	EUSELI	±15-25%	0.4 g/kg
Saccharose	AOAC 982.14, mod.	EUSELI	±15-30%	0.4 g/kg
Lactose	AOAC 982.14, mod.	EUSELI	±15-25%	0.4 g/kg
Maltose	AOAC 982.14, mod.	EUSELI	±15-25%	0.4 g/kg
Galactose	AOAC 982.14, mod.	EUSELI	±25%	0.4 g/kg
Ash	NMKL 173	EUSELI	±10%	1 g/kg
Water[6]	NKML 23	EUSELI	±10%	1 g/kg

1 Lean dairy products were analysed using the method ISO 1211/IDF 1:2010 according to Röse Gotlieb. Measurement uncertainty was ±8% and LOQ was 0.2 g/kg.
2 Measurement uncertainty was ±20% for fats and oils.
3 Modified AOAC 2009.1 was used for the food groups cereal products and pastries (AOAC2009.1 HEC4F) with the same measurement uncertainty and LOQ as AOAC 2009.01.
4 Resistant starch is not included in the analysis.
5 Starch analysis (MJ011) includes free glucose in the following food groups: meat, processed meat, lean and fatty fish, lean and fatty dairy products, egg, fats and oils with the same measurement uncertainty and LOQ as MJ010.
6 Fats and oils were analysed according to Karl Fischer (ISO 8534:2017, measurement uncertainty: ±25%, LOQ: 1 g/kg). Lean and fatty dairy products were analysed using ISO 1358/IDF 151:2005 and ISO 5534/IDF 4:2004, respectively (dry substance) and with measurement uncertainty of ±10%.

A4.2. Vitamins

Fat-soluble vitamins

The fat-soluble vitamins were analysed at the Swedish Food Agency. Methods and principles are presented in Table A4.2.1, along with measurement uncertainty and LOQ. In order to determine vitamin A in human diet, different analytical methods were required. One for provitamin A, carotenoids with vitamin A activity (β-carotene, α-carotene, and β-cryptoxanthin), in foods of plant origin, and one for preformed vitamin A (retinol and retinyl esters) in foods from animal sources. Carotenoids and retinols were determined using HPLC-DAD and HPLC-UV, respectively. The method used for retinol simultaneously determine vitamin E, but retinol was detected by UV and α-tocopherol with fluorescence (HPLC-FLD). With this method all tocopherols and tocotrienols could be determined. Vitamin K_1 (phylloquinone) and vitamin K_2 (menaquinone-4) were determined separately using HPLC-FLD, and the sum was reported as vitamin K. Menaquinone-7, menaquinone-8 and menaquinone-9 were determined in fatty dairy products, and, for menaquinone-9, also in lean dairy products and eggs (see Appendix 5, section A5.2). Vitamin D was analysed by HPLC-UV. Vitamin D_3, (cholecalcipherol) was determined using vitamin D_2 (erogcalcipherol) as an internal standard. For one food group, plant-based drinks, vitamin D_2 was determined instead using vitamin D_3 as internal standard.

Water-soluble vitamins

The water-soluble vitamins were analysed by Eurofins Vitamin Testing in Denmark. The analytical methods, LOQ and measurement uncertainty are described in Table A4.2.1. The total amount of free thiamin and of free riboflavin were determined after dephosphorylation of phosphorylated forms using HPLC. Total amount of folate was determined by a microbiological assay after deconjugation of glutamate residues in natural forms of the vitamin.

Table A4.2.1. Chemical methods, measurement uncertainty and limit of quantification (LOQ), used for determining the content of vitamins in the Market Basket 2022.

Vitamin/Substance	Method reference	Method description	Measurement uncertainty	LOQ
Vitamin A (all-trans-retinol)	SLV-m049-f Determination of vitamin A in foods by HPLC-UV	Ascorbic acid added as antioxidant. Saponification with KOH for 30 min at 95 °C. Extraction with cyclohexane using a separatory funnel. HPLC: Amino column, 250 × 4.6 mm, 3 µm particles. Mobile phase: 3% isopropanol in n-heptane. UV detection, 325 nm.	± 9-18%	6 ug/100g
Vitamin A (β-carotene, α -carotene, β-cryptoxanthin)	SLV-m138-f Determination of carotenoids in foods by HPLC-DAD	Extraction in ethanol, hydrolyzation and thereafter addition with tetrahydrofuran. After neutralization of pH with phosphoric acid, renewed extraction followed by evaporation of the organic phase to suitable volume. Separation by reversed phase HPLC and detection by diode-array-detector.	± 12-18%	5 ug/100g
Vitamin D (D_3 cholecalciferol, D_2 erogcalciferol)	SLV-m061-f Determination of vitamin D_3 and vitamin D_2 respectively in foods by HPLC-UV	Ascorbic acid added as antioxidant. Vitamin D2 added as internal standard. Saponification with KOH for 30 min at 95 °C. Extraction with n-heptane. Sample clean-up with semi-preparative HPLC (silica). Reversed phase HPLC (C18), 250 × 4.6 mm, 5 µm particles. Mobile phase: 20% methanol in acetonitrile. UV detection, 265 nm.	± 7-14%	0.3 ug/100g
Vitamin E (α-tocopherol)	SLV-m049-f Determination of vitamin E in foods by HPLC and fluorescence detection	Ascorbic acid added as antioxidant. Saponification with KOH for 30 min at 95 °C. Extraction with cyclohexane using a separatory funnel. HPLC: Amino column, 250 × 4.6 mm, 3 µm particles. Mobile phase: 3% isopropanol in n-heptane. Fluorescence detection, λex 295 nm, λem 327 nm.	± 8-18%	0.013 mg/100g
Vitamin K (K_1 phylloquinone K_2 menaquinone-4)	SLV-m057-f Determination of vitamin K in foods by HPLC and fluorescence detection	Sample is mixed with 70 % ethanol after addition of internal standard. Extraction of fat-soluble components to heptane by reflux and extract is then evaporated to suitable volume. Separation on reversed phase HPLC column followed by reduction on a zinc powder column. Detection by fluorescence λex 248 nm, λem 418 nm.	± 9-16%	1 ug/100g
Thiamin Thiamin HCl	DJ074 In-house modified version of standard EN14122 Foodstuffs -	Vitamin B1 is extracted from the sample in an autoclave by acid hydrolysis. After dephosphorylation of phosphorylated forms, quantified by reversed phase-HPLC with fluorometric detection λex	± 16%	0.018 mg/100g

Vitamin/Substance	Method reference	Method description	Measurement uncertainty	LOQ
	Determination of vitamin B1 by HPLC	368 nm, λem 440 nm after post-column oxidation to thiochrome. Result is reported as mg thiamin hydrochloride/100 g (= thiamin x 1,27)		
Riboflavin	DJB33 In-house modified version of standard EN14152 Foodstuffs - Determination of vitamin B2 by HPLC	Vitamin B2 is extracted from the sample in an autoclave by acid hydrolysis. After dephosphorylation of phosphorylated forms, quantified by reversed phase-HPLC with fluorometric detection.	± 16%	0,010 mg/100g
Folate	A7286 In-house modified version of previous NMKL standard 111:1985 Determination of folic acid by microbiological assay in milk	Folate (including folic acid) is extracted from the sample in an autoclave using a buffer solution, followed by an enzymatic digestion with human plasma and pancreas V and finally by a second autoclave treatment. After dilution with basal medium containing all required growth nutrients except folic acid the growth response of *Lactobacillus rhamnosus* (ATCC 7469) to extracted folate is measured turbidimetrically and is compared to calibration solutions with known concentrations.	± 30%	5 ug/100g

A4.3. Minerals

Essential elements, excluding iodine

The analysis of total concentrations of essential (and non-essential) elements in the samples were performed by ALS Scandinavia AB, Luleå by High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS). In order to achieve lowest possible detection limits and to avoid contamination risks associated with additional homogenization of samples, sample amount was increased to >1 g per digestion. Weighing was done directly into acid washed, 50 ml plastic vessels. After addition of concentrated nitric acid (10:1, v/m), samples were left to react overnight followed by graphite hot-block digestion (105˚C, 2 hours). After cooling, volume of transparent digests was adjusted to 40 ml with MQ-water. Prior to analysis stage, samples were further diluted to provide total dilution factor of approximately 100 and nitric acid concentration of 1.4 M. A set of preparation blanks, duplicate samples and control materials was prepared alongside with samples.

Concentration of elements of interest were measured by HR-ICP-MS (ELEMENT XR, Thermo Scientific), using combination of internal standardization (In and Lu added to all solutions at 1 µg/l) and external calibration with set of standards matching sample digests in acid strength. All-PFA introduction system, high sensitivity X-type skimmer cone and FAST autosampler (excluding contact of sample digests with peristaltic pump tubing) allows instrumental sensitivity in excess of 2000 counts/s for 1 ng/l Indium-115. In order to minimize matrix effects and to increase sensitivity of arsenic, selenium and cadmium, the ICP was operated with methane addition. Spectral interferences were either avoided using high resolution settings of MS or mathematically corrected (tin, indium and molybdenum oxide interferences on cadmium isotopes). Method detection limits (defined as 3 times the standard deviation of analyte concentrations measured in a set of preparation blanks) is presented in Table 11.4:1 and the measurement uncertainty is 15%. The method is based on the accredited method that ALS Scandinavia AB use in their routine work for analysis of biological matrices (Engström et al., 2004, Rodushkin et al., 2008). The laboratory routinely participates in proficiency tests, and both certified and in-house reference materials are routinely analysed and evaluated together with the samples for careful control of the quality of the analyses.

Iodine

Iodine concentrations were analysed by SGS Analytics in Jena, Germany, using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). SGS Analytics is an accredited laboratory. Limits of quantification was 10 µg/kg for both solid and liquid samples. Measurement uncertainty for iodine was approximately 20%.

A4.4. Metals

The analysis of total concentrations of non-essential (and essential) elements in the samples were performed by ALS Scandinavia AB, Luleå by High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS). In order to achieve lowest possible detection limits and to avoid contamination risks associated with additional homogenization of samples, sample amount was increased to >1 g per digestion. Weighing was done directly into acid washed, 50 ml plastic vessels. After addition of concentrated nitric acid (10:1, v/m), samples were left to react overnight followed by graphite hot-block digestion (105˚C, 2 hours). After cooling, volume of transparent digests was adjusted to 40 ml with MQ-water. Prior to analysis stage, samples were further diluted to provide total dilution factor of approximately 100 and nitric acid concentration of 1.4 M. A set of preparation blanks, duplicate samples and control materials was prepared alongside with samples.

Concentration of elements of interest were measured by HR-ICP-MS (ELEMENT XR, Thermo Scientific), using combination of internal standardization (In and Lu added to all solutions at 1 µg/l) and external calibration with set of standards matching sample digests in acid strength. All-PFA introduction system, high sensitivity X-type skimmer cone and FAST autosampler (excluding contact of sample digests with peristaltic pump tubing) allows instrumental sensitivity in excess of 2000 counts/s for 1 ng/l Indium-115 and background equivalent concentrations for ultra-trace elements (cadmium, lead, arsenic) below 0.2 ng/l. In order to minimize matrix effects and to increase sensitivity of arsenic, selenium and cadmium, the ICP was operated with methane addition. Spectral interferences were either avoided using high resolution settings of MS or mathematically corrected (tin, indium and molybdenum oxide interferences on cadmium isotopes). Method detection limits (defined as 3 times the standard deviation of analyte concentrations measured in a set of preparation blanks) is presented in Table 11.4:1 and the measurement uncertainty is between 30 and 50 % depending on the element and its level of concentration. The method is based on the accredited method that ALS Scandinavia AB use in their routine work for analysis of biological matrices (Engström et al., 2004, Rodushkin et al., 2008). The laboratory routinely participates in proficiency tests, and both certified and in-house reference materials are routinely analysed and evaluated together with the samples for careful control of the quality of the analyses.

Inorganic arsenic

The analysis of inorganic arsenic was performed by HPLC-ICP-MS (high performance liquid chromatography – inductively coupled plasma mass spectrometry) at the Swedish Food Agency. An HPLC (Agilent 1260) equipped with a strong anion exchange column (Dionex Ionpac AS7 and precolumn Dionex Ionpac AG7) were used to separate the different arsenic compounds in the sample. The analytical method is based on the European standard EN 16802:2016 and is accredited in accordance with ISO/IEC 17025 by SWEDAC for inorganic arsenic in food within the range 1-25 000 µg/kg. The limit of detection (LOD) was between 0.4 and 3 µg iAs/kg depending on the dilution of the sample before analysis, and the measurement uncertainty was +/- 19 %.

A4.5. PCBs and dioxins

The analysis of PCBs and PCDD/Fs was performed at the Swedish Food Agency (SFA), Sweden. The 17 2,3,7,8-chloro-substituted PCDD/Fs, 12 dioxin-like PCBs (dl-PCBs; CB 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189) and six non dioxin-like (ndl-PCBs; CB 28, 52, 101, 138, 153, 180) were analysed.

The samples of lean dairy products and plant-based drinks were treated with 2 ml potassium oxalate (35 % in water) and then liquid-liquid extracted using ethanol (100 ml) diethyl ether (50 ml) and n-pentane (120 ml).

Solid food groups were extracted by pressurized liquid extraction (PLE) using a system from Fluid Management Systems (MA, USA). Ethanol and toluene (7:3) were used for the extraction of meat, lean fish and meat substitutes. The other matrices were extracted with n-pentane and acetone (7:3). Two extraction cycles of 20 minutes each, with temperature 100°C and the pressure 1500 psi, were applied. The extracts were dried using dried sodium sulphate, followed by evaporation of the solvent and gravimetric lipid weight determination. Samples extracted with ethanol:toluen were further cleaned up using methyl-tert-butyl-ether (MTBE) before the lipid determination. Lipid removal, clean-up and fractionations were performed with a GO-2HT from Miura. The system uses four serially coupled liquid chromatography (LC) columns, a silver-nitrate column, a sulphuric-acid, a carbon and finally an alumina column.

Final determination was performed with gas chromatography and high-resolution mass spectrometry (GC-HRMS) (Thermo Trace 1300 GC and Thermo DFS Magnetic Sector instrument) using isotopic dilution technique. The ndl-PCBs were injected on a HT8 column with a split/splitless injector in splitless mode. The dl-PCBs and PCDD/Fs were injected on a Rtx-Dioxin2 column with a programmed temperature vaporizer (PTV) injector in solvent vent mode. CB 123 was quantified on the HT8 column. The HRMS was operated in electron ionization (EI) mode, using single ion monitoring (SIM) at the resolution of 10 000. The limit of quantification (LOQ), defined as signal-to-noise ratio (S/N)=3, was determined for all individual congeners in each sample.

13C-labelled surrogate standards for all analysed congeners were added to the samples prior to extraction. Control and blank samples were analysed together with the samples in every series to verify the accuracy and precision of the measurements. The trueness of the method has also been proven by participating in proficiency tests. The laboratory is accredited according to ISO/IEC 17025 for the analysis of PCDD/Fs and PCBs in milk, dairy products, fats, fish, meat, eggs, baby food, spices, whey protein powder and blood serum.

Appendix 5. Additional compounds analysed in the Market Basket 2022

A5.1. Fatty acids

Table A5.1.1 presents concentrations of fatty acids in food groups using lower and upper bound approach. Table A5.1.2 shows the proportion of individual fatty acids of total fatty acids (%) in the food groups.

Table A5.1.1. Concentrations of fatty acids per kg in food groups using lower and upper bound approach in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
FA factor[1]		0.73	0.96	0.95	0.95	0.70	0.90	0.80	0.94	0.94	0.94	0.83	0.96	0.93	0.96	0.96
Fat, total (g/kg)	Mean	36	158	117	197	23	143	104	19	252	25	99	673	27	19	104
	Min	31	147	115	192	20	132	90	18	246	17	99	662	25	17	98
	Median	37	160	117	200	22	133	107	19	249	27	99	669	26	20	104
	Max	40	167	118	200	26	164	116	20	261	32	99	687	30	20	110
SFA (g/kg)	Mean	3.4-3.9	59-61	47-48	75-78	2.0-2.3	22-24	21-22	13-13	166-168	2.4-2.9	25-27	193-200	3.6-4.1	3.4-3.7	53-54
	Min	3.1-3.5	54-56	46-48	74-77	1.8-2.1	20-22	14-15	12-12	160-162	1.6-1.9	25-26	188-195	2.9-3.3	1.5-1.8	50-52
	Median	3.2-3.8	60-62	47-48	75-78	2.0-2.3	20-22	23-24	13-13	164-166	2.8-3.4	25-27	190-197	3.8-4.3	2.0-2.4	52-54
	Max	3.9-4.4	62-64	47-48	76-80	2.2-2.5	25-27	27-28	13-14	173-175	2.9-3.5	26-28	200-207	4.2-4.7	6.5-6.9	55-57
MUFA (g/kg)	Mean	12-13	69-70	53-54	93-94	8.3-8.4	67-68	37-37	4.5-4.5	62-63	13-14	40-40	316-320	16-16	10-11	39-40

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Min	10-10	66-67	53-54	90-91	7.6-7.6	59-59	29-29	4.2-4.3	61-62	8.6-8.7	38-38	314-317	14-14	8.1-8.2	36-37
	Median	12-13	67-68	54-54	93-95	8.0-8.1	64-65	40-41	4.4-4.4	62-62	14-14	41-41	315-319	15-15	11-11	39-39
	Max	15-15	75-76	54-55	94-96	9.5-9.6	79-79	42-43	4.8-4.9	63-63	17-18	41-41	319-323	18-18	12-12	42-42
PUFA (g/kg)	Mean	10-11	24-26	9.9-12	19-21	5.4-5.6	40-40	25-27	0.58-0.90	7.7-12	7.8-8.2	17-18	133-144	5.6-6.0	4.3-4.7	7.8-9.6
	Min	9.0-9.4	21-24	9.2-11	17-20	4.7-4.8	36-36	22-24	0.53-0.84	7.3-11	5.3-5.6	16-17	128-139	5.5-6.0	2.5-2.8	6.9-8.6
	Median	11-11	24-27	10-12	19-22	5.4-5.5	39-40	24-25	0.60-0.92	7.7-12	8.5-8.9	17-18	131-142	5.6-6.1	4.4-4.8	8.0-9.9
	Max	11-12	25-28	11-12	20-22	6.1-6.3	44-45	30-31	0.61-0.95	7.9-12	9.5-10	18-19	139-151	5.7-6.1	6.1-6.4	8.5-10
n-3 PUFA (g/kg)	Mean	1.4-1.7	4.3-5.7	0.87-1.9	1.4-2.9	2.9-3.0	23-23	4.5-5.2	0.10-0.27	1.0-3.1	1.6-1.8	1.9-2.6	36-42	0.58-0.80	0.21-0.38	0.29-1.2
	Min	1.1-1.3	3.7-5.0	0.77-1.8	1.1-2.8	2.6-2.7	20-21	2.8-3.4	0.09-0.24	0.98-3.1	1.1-1.3	1.7-2.4	34-39	0.55-0.75	0.19-0.36	0.25-1.1
	Median	1.5-1.8	4.4-5.9	0.91-1.9	1.4-2.9	3.1-3.1	22-22	5.2-6.0	0.11-0.28	1.0-3.1	1.7-1.9	1.9-2.6	35-41	0.59-0.83	0.19-0.36	0.28-1.2
	Max	1.7-1.9	4.8-6.2	0.93-1.9	1.6-3.1	3.1-3.2	26-26	5.5-6.3	0.11-0.28	1.1-3.3	2.0-2.3	2.1-2.7	39-44	0.61-0.84	0.27-0.41	0.33-1.2
n-6 PUFA (g/kg)	Mean	9.0-9.2	18-19	8.2-8.7	16-17	2.4-2.5	16-16	21-21	0.28-0.40	4.2-5.6	6.2-6.3	15-15	88-92	5.0-5.2	4.1-4.2	6.7-7.4
	Min	8.0-8.1	17-18	7.5-8.1	15-16	2.1-2.1	14-15	17-18	0.25-0.37	4.1-5.5	4.2-4.3	14-14	85-90	4.9-5.1	2.2-2.3	6.0-6.7
	Median	9.2-	19-	8.2-	17-	2.3-	16-	18-	0.28-	4.2-	6.8-	14-	87-	5.1-	4.2-	6.7-

		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
		9.4	20	8.7	18	2.4	17	19	0.41	5.7	7.0	15	91	5.2	4.4	7.5
	Max	9.8-10	19-21	8.8-9.4	17-18	3.0-3.0	17-18	27-28	0.29-0.42	4.3-5.7	7.4-7.7	16-16	91-96	5.1-5.3	5.9-6.0	7.3-8.0
TFA (g/kg)	Mean	0.00-0.16	0.43-1.1	1.6-1.9	0.79-1.7	0.05-0.13	0.88-1.4	0.23-0.56	0.73-0.74	10-11	0.00-0.14	0.11-0.52	6.7-9.3	0.00-0.15	0.03-0.12	0.51-0.91
	Min	0.00-0.13	0.33-1.0	1.5-1.9	0.71-1.7	0.04-0.11	0.75-1.2	0.20-0.51	0.68-0.69	10-10	0.00-0.09	0.10-0.51	5.8-8.5	0.00-0.14	0.00-0.10	0.45-0.82
	Median	0.00-0.16	0.39-1.2	1.5-1.9	0.77-1.7	0.05-0.13	0.85-1.3	0.22-0.55	0.72-0.74	10-11	0.00-0.15	0.11-0.52	6.5-9.1	0.00-0.15	0.04-0.14	0.50-0.90
	Max	0.00-0.18	0.57-1.2	1.7-2.0	0.91-1.8	0.06-0.14	1.0-1.6	0.26-0.63	0.78-0.80	10-11	0.00-0.18	0.12-0.53	7.7-10.3	0.00-0.17	0.05-0.14	0.57-0.99

1 g/kg = 0.1 g/100 g. Lower bound approach, non-detects are set to 0; upper bound approach, non-detects are set to LOQ; NA, not analysed. FA factor, fatty acid factor; SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acids; TFA, trans fatty acid.

[1] FA was not analysed in vegetables due to low total fat content (<0.5% fat). Fat content in beverages and coffee/tea were assumed to be logical zero and no analyses were performed. FAs were not analysed in subgroups pizza/hand pies.

[2] A FA factor was applied to convert the total fat content into grams fatty acids (Greenfield and Southgate, 2003). The factors in Greenfield et al was used with the following exceptions: For cereal products and fruits, mean FA factors were calculated based on total fat and fatty acid contents of the individual foot items in the food group, respectively. Fat content data from Swedish Food Agency´s food composition database were used in the calculations. For pastries, potatoes and sugar/sweets, FA factor for fats and oils (0.96) were used because most fat in these food groups were from fats and oils. For meat and processed meat, FA factor for bovine and poultry (0.95) was used because it was closest to estimated mean FA factor (0.94). For meat substitutes, FA factor for vegetables were used. For plant-based drinks, FA factor for oat was used because most of the sample was oat milk (64%).

Table A5.1.2. Proportion of individual fatty acids of total fatty acids (%) in food groups in the Market Basket 2022 (N=3 samples per food group).

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
4:0	Mean	0	0.32	0	0	0	0	0	3.8	3.7	0	0	0.98	0	0	0.71
	Min	<0.1	0.29	<0.1	<0.1	<0.1	<0.1	<0.1	3.6	3.6	<0.1	<0.1	0.89	<0.1	<0.1	0.70
	Median	<0.1	0.35	<0.1	<0.1	<0.1	<0.1	<0.1	3.9	3.7	<0.1	<0.1	0.99	<0.1	<0.1	0.71
	Max	<0.1	0.32	<0.1	<0.1	<0.1	<0.1	<0.1	3.9	3.7	<0.1	<0.1	1.1	<0.1	<0.1	0.74
6:0	Mean	0	0.16	0	0	0	0	0	1.9	1.8	0	0	0.49	0	0	0.36
	Min	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	1.8	1.8	<0.1	<0.1	0.45	<0.1	<0.1	0.35
	Median	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	1.9	1.8	<0.1	<0.1	0.50	<0.1	<0.1	0.35
	Max	<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	2.0	1.9	<0.1	<0.1	0.53	<0.1	<0.1	0.37
8:0	Mean	0	1.0	0	0	0	0	1.2	1.4	1.4	0	0	0.50	0	0	0.70
	Min	<0.1	0.65	<0.1	<0.1	<0.1	<0.1	0.72	1.4	1.4	<0.1	<0.1	0.48	<0.1	<0.1	0.62
	Median	<0.1	1.2	<0.1	<0.1	<0.1	<0.1	1.4	1.4	1.4	<0.1	<0.1	0.50	<0.1	<0.1	0.66
	Max	<0.1	1.2	<0.1	<0.1	<0.1	<0.1	1.6	1.4	1.4	<0.1	<0.1	0.54	<0.1	<0.1	0.82
10:0	Mean	0	0.93	0.12	0	0	0	1.0	3.4	3.4	0	0	0.94	0	0	0.91
	Min	<0.1	0.63	0.13	<0.1	<0.1	<0.1	0.58	3.3	3.4	<0.1	<0.1	0.98	<0.1	<0.1	0.90
	Median	<0.1	1.1	0.11	<0.1	<0.1	<0.1	1.2	3.4	3.3	<0.1	<0.1	0.91	<0.1	<0.1	0.85
	Max	<0.1	1.1	0.11	<0.1	<0.1	<0.1	1.3	3.4	3.5	<0.1	<0.1	0.94	<0.1	<0.1	0.99
10:1	Mean	0	0	0	0	0.10	0	0	0.28	0.25	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.27	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.28	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.21	<0.1	<0.1	0.28	0.26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
11:0	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
12:0	Mean	0.23	7.3	0.16	0.07	0	0	8.1	3.8	3.8	0	0	2.3	0	0.07	3.4

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Min	<0.1	4.6	0.16	<0.1	<0.1	<0.1	4.5	3.7	3.7	<0.1	<0.1	2.2	<0.1	<0.1	3.0
	Median	0.28	8.6	0.16	<0.1	<0.1	<0.1	9.4	3.8	3.9	<0.1	<0.1	2.2	<0.1	<0.1	3.2
	Max	0.37	8.7	0.17	0.11	<0.1	<0.1	10	4.0	3.9	<0.1	<0.1	2.4	<0.1	0.12	4.0
12:1	Mean	0	0	0	0	0	0	0	0.20	0.19	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.21	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
13:0	Mean	0	0	0	0	0	0	0	0.09	0.11	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
14:0	Mean	0.18	3.4	2.0	1.4	0.51	3.2	3.2	12	11	0	0.26	3.6	0.07	0.26	3.3
	Min	0.11	2.5	1.9	1.4	0.45	3.1	1.8	12	11	<0.1	0.24	3.5	<0.1	<0.1	3.2
	Median	0.20	3.8	2.0	1.4	0.51	3.2	3.7	12	11	<0.1	0.27	3.6	<0.1	<0.1	3.4
	Max	0.24	4.0	2.1	1.5	0.55	3.4	4.2	12	11	<0.1	0.28	3.6	0.11	0.68	3.4
14:0 iso	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
14:1	Mean	0	0	0.24	0	0	0	0	1.1	1.0	0	0	0.26	0	0	0.19
	Min	<0.1	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	1.1	1.0	<0.1	<0.1	0.26	<0.1	<0.1	0.17
	Median	<0.1	<0.1	0.24	<0.1	<0.1	<0.1	<0.1	1.1	1.0	<0.1	<0.1	0.26	<0.1	<0.1	0.17
	Max	<0.1	<0.1	0.29	<0.1	<0.1	<0.1	<0.1	1.1	1.0	<0.1	<0.1	0.27	<0.1	<0.1	0.22
14:1 trans	Mean	0	0	0	0	0	0	0	0.22	0.20	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.22	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.22	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.22	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
15:0	Mean	0	0	0.22	0	0.11	0.23	0	1.1	1.1	0	0	0.29	0	0	0.21
	Min	<0.1	<0.1	0.21	<0.1	0.11	0.22	<0.1	1.0	1.1	<0.1	<0.1	0.29	<0.1	<0.1	0.20
	Median	<0.1	<0.1	0.21	<0.1	0.11	0.23	<0.1	1.1	1.1	<0.1	<0.1	0.29	<0.1	<0.1	0.20
	Max	<0.1	<0.1	0.23	<0.1	0.12	0.24	<0.1	1.1	1.1	<0.1	<0.1	0.29	<0.1	<0.1	0.23
15:0 anteiso	Mean	0	0	0	0	0	0	0	0.39	0.40	0	0	0.11	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.39	0.39	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.39	0.40	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.39	0.41	<0.1	<0.1	0.12	<0.1	<0.1	<0.1
15:0 iso	Mean	0	0	0	0	0	0.11	0	0.23	0.23	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	0.23	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	0.23	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	0.24	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
15:1	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:0	Mean	10	18	25	25	9	11	6.8	32	31	7.1	23	14	11	13	26
	Min	9.3	15	25	24	8.6	10	6.5	32	31	6.7	22	14	9.8	5.3	25
	Median	9.5	17	25	24	9.4	10	6.7	32	31	7.0	23	15	11	6.0	26
	Max	11	21	25	25	9.5	11	7.2	32	32	7.5	24	15	12	29	27
16:0 anteiso	Mean	0	0	0.17	0	0.07	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.18	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:0 iso	Mean	0	0	0	0	0	0	0	0.20	0.19	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:1	Mean	0.23	0.38	3.1	2.8	1.1	3.0	0.17	1.6	1.7	0.21	2.9	0.61	2.3	0.18	0.46
	Min	0.22	0.34	3.0	2.7	0.97	3.0	0.14	1.6	1.7	0.21	2.7	0.60	1.2	0.15	0.42
	Median	0.22	0.37	3.2	2.9	1.1	3.0	0.18	1.6	1.7	0.21	3.0	0.61	2.3	0.19	0.46
	Max	0.24	0.42	3.2	2.9	1.3	3.1	0.18	1.7	1.7	0.21	3.1	0.63	3.6	0.19	0.52
16:1 trans	Mean	0	0	0.11	0	0	0	0	0.30	0.31	0	0	0	0	0	0
	Min	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.30	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.30	0.32	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	0.31	0.33	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:2 n-4	Mean	0	0	0	0	0.09	0.36	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.36	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	0.11	0.36	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.12	0.37	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:3	Mean	0	0	0.45	0.39	0.13	0.12	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	0.45	0.37	0.12	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.45	0.39	0.14	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.46	0.41	0.14	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16:4 n-3	Mean	0	0	0	0	0	0.19	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
17:0	Mean	0	0.09	0.54	0.39	0.13	0.16	0	0.45	0.46	0	0.18	0.14	0	0	0.19
	Min	<0.1	<0.1	0.52	0.36	0.13	0.15	<0.1	0.44	0.46	<0.1	0.17	0.14	<0.1	<0.1	0.17
	Median	<0.1	0.11	0.55	0.38	0.13	0.16	<0.1	0.45	0.46	<0.1	0.18	0.14	<0.1	<0.1	0.19
	Max	<0.1	0.11	0.57	0.43	0.14	0.16	<0.1	0.46	0.47	<0.1	0.18	0.14	<0.1	<0.1	0.21
17:0 anteiso	Mean	0	0	0.24	0.07	0	0	0	0.32	0.36	0	0	0	0	0	0
	Min	<0.1	<0.1	0.23	<0.1	<0.1	<0.1	<0.1	0.32	0.35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Median	<0.1	<0.1	0.24	<0.1	<0.1	<0.1	<0.1	0.32	0.36	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.26	0.10	<0.1	<0.1	<0.1	0.34	0.37	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
17:0 iso	Mean	0	0	0.16	0	0	0	0	0.40	0.41	0	0	0.09	0	0	0
	Min	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	0.38	0.41	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	0.40	0.42	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	0.41	0.42	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
17:1	Mean	0	0	0	0	0	0.16	0	0.16	0.18	0	0.10	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	0.16	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	0.16	0.19	<0.1	0.12	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.17	<0.1	0.17	0.19	<0.1	0.12	<0.1	<0.1	<0.1	<0.1
18:0	Mean	2.1	7.1	14	13	2.2	2.2	3.6	9.8	9.9	2.6	7.4	5.5	2.1	3.3	16
	Min	1.9	7.0	13	13	2.2	2.0	3.0	9.5	9.7	2.4	7.2	5.1	1.5	2.7	16
	Median	2.0	7.0	14	14	2.2	2.1	3.9	9.7	9.7	2.6	7.3	5.5	2.1	3.3	16
	Max	2.5	7.2	14	14	2.2	2.4	3.9	10	10	2.8	7.8	5.8	2.5	3.9	16
18:0 anteiso	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18:0 iso	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18:1	Mean	46	45	44	46	50	36	43	21	23	55	45	47	60	58	38
	Min	44	43	44	45	49	35	39	21	22	54	43	46	57	42	38
	Median	45	46	44	46	50	37	44	21	23	54	46	48	60	57	38
	Max	49	46	44	46	50	37	46	22	23	57	46	48	63	74	39
18:1 trans	Mean	0	0.24	0.99	0.42	0.31	0.48	0.15	2.7	3.0	0	0.13	0.82	0	0	0.37

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Min	<0.1	0.23	0.95	0.37	0.29	0.44	0.13	2.6	2.9	<0.1	0.12	0.69	<0.1	<0.1	0.35
	Median	<0.1	0.24	0.97	0.40	0.31	0.46	0.15	2.6	3.0	<0.1	0.13	0.81	<0.1	<0.1	0.37
	Max	<0.1	0.25	1.1	0.50	0.34	0.54	0.17	2.7	3.2	<0.1	0.15	0.96	<0.1	<0.1	0.40
18:2	Mean	34	13	7.1	8.2	15	11	26	2.6	2.7	26	16	15	20	22	7.5
	Min	31	12	6.7	7.6	14	10	20	2.6	2.6	25	15	15	18	14	7.1
	Median	36	13	7.1	8.4	14	11	20	2.6	2.6	27	16	15	21	22	7.3
	Max	36	13	7.6	8.6	16	12	38	2.7	2.9	27	17	15	22	31	8.2
18:2 n-6	Mean	34	12	6.8	8.1	15	11	26	1.5	1.7	26	16	14	20	22	6.7
	Min	31	12	6.3	7.5	14	10	20	1.5	1.6	25	15	13	18	14	6.4
	Median	36	12	6.8	8.3	14	11	20	1.5	1.7	27	16	14	21	22	6.4
	Max	36	12	7.3	8.5	16	12	38	1.6	1.7	27	17	14	22	30	7.3
18:2 conj	Mean	0	0	0.19	0.10	0	0	0.11	0.48	0.45	0.12	0	0.23	0	0	0
	Min	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	0.48	0.44	0.11	<0.1	0.22	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.19	0.12	<0.1	<0.1	0.13	0.48	0.46	0.11	<0.1	0.23	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.21	0.12	<0.1	<0.1	0.14	0.49	0.46	0.15	<0.1	0.23	<0.1	<0.1	<0.1
18:2 trans	Mean	0	0.07	0.32	0	0	0.20	0.09	0.70	0.72	0	0	0.22	0	0.17	0.13
	Min	<0.1	<0.1	0.32	<0.1	<0.1	0.17	<0.1	0.69	0.71	<0.1	<0.1	0.19	<0.1	<0.1	0.11
	Median	<0.1	<0.1	0.32	<0.1	<0.1	0.18	<0.1	0.69	0.71	<0.1	<0.1	0.22	<0.1	0.21	0.14
	Max	<0.1	0.11	0.34	<0.1	<0.1	0.26	0.16	0.71	0.74	<0.1	<0.1	0.24	<0.1	0.24	0.15
18:3 n-3	Mean	5.4	2.8	0.79	0.65	5.3	4.5	5.3	0.57	0.43	6.9	1.1	5.5	2.3	1.2	0.29
	Min	4.9	2.6	0.71	0.61	4.8	4.4	3.8	0.52	0.43	6.5	1.0	5.3	2.1	0.98	0.27
	Median	5.2	2.8	0.81	0.61	5.0	4.5	5.9	0.56	0.43	6.8	1.1	5.5	2.4	0.98	0.27
	Max	6.2	3.1	0.84	0.72	6.2	4.5	6.1	0.63	0.43	7.3	1.2	5.8	2.5	1.7	0.33
18:3 n-3 trans	Mean	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
18:3 n-6	Mean	0	0	0	0	0	0.14	0	0	0	0	0.07	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
18:4 n-3	Mean	0	0	0	0	0.14	1.2	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	0.12	1.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	0.14	1.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.16	1.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:0	Mean	0.32	0.39	0.17	0.19	0.40	0.28	0.39	0.16	0.15	0.43	0.00	0.42	0.35	0.37	0.51
	Min	0.27	0.38	0.16	0.18	0.38	0.28	0.33	0.16	0.15	0.42	<0.1	0.41	0.26	0.34	0.47
	Median	0.33	0.38	0.17	0.18	0.41	0.29	0.41	0.16	0.15	0.43	<0.1	0.42	0.32	0.38	0.50
	Max	0.36	0.41	0.18	0.19	0.43	0.29	0.43	0.16	0.15	0.45	<0.1	0.44	0.47	0.40	0.55
20:1	Mean	0.75	0.45	0.71	0.90	1.5	6.2	0.71	0.14	0.12	0.91	0.26	0.67	0.77	0.45	0.13
	Min	0.62	0.44	0.69	0.88	1.4	5.6	0.46	0.14	0.11	0.87	0.22	0.64	0.65	0.30	0.12
	Median	0.79	0.44	0.71	0.89	1.5	6.4	0.83	0.14	0.11	0.90	0.27	0.67	0.68	0.45	0.12
	Max	0.85	0.47	0.73	0.93	1.7	6.5	0.83	0.15	0.13	0.96	0.30	0.70	0.97	0.59	0.16
20:1 trans	Mean	0	0	0	0	0	0	0	0.13	0.12	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.13	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.13	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.14	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:2 n-6	Mean	0	0	0.24	0.37	0.11	0.78	0	0	0	0	0.13	0	0	0	0
	Min	<0.1	<0.1	0.22	0.34	0.10	0.71	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.24	0.37	0.11	0.72	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.26	0.40	0.11	0.92	<0.1	<0.1	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1
20:3 n-3	Mean	0	0	0	0.09	0	0.35	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	0.11	<0.1	0.33	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Max	<0.1	<0.1	<0.1	0.11	<0.1	0.42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:3 n-6	Mean	0	0	0	0	0	0.15	0	0	0	0	0.13	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.17	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
20:4 n-3	Mean	0	0	0	0	0.09	0.73	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.61	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	0.10	0.76	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.11	0.82	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
20:4 n-6	Mean	0	0	0.33	0.27	0.58	0.26	0	0	0.11	0	1.58	0	0	0	0
	Min	<0.1	<0.1	0.31	0.26	0.55	0.24	<0.1	<0.1	0.11	<0.1	1.6	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	0.33	0.28	0.59	0.24	<0.1	<0.1	0.11	<0.1	1.6	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	0.35	0.28	0.60	0.28	<0.1	<0.1	0.11	<0.1	1.6	<0.1	<0.1	<0.1	<0.1
20:5 n-3	Mean	0	0	0	0	5.0	3.6	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	4.2	3.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	5.3	3.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	5.4	3.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
21:5 n-3	Mean	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22:0	Mean	0.26	0.21	0	0	0.21	0.12	0.30	0	0	0.24	0	0.20	0.68	0.55	0.11
	Min	0.23	0.17	<0.1	<0.1	0.20	0.11	0.24	<0.1	<0.1	0.24	<0.1	0.20	0.50	0.26	<0.1
	Median	0.27	0.20	<0.1	<0.1	0.21	0.12	0.24	<0.1	<0.1	0.24	<0.1	0.20	0.54	0.70	<0.1
	Max	0.28	0.26	<0.1	<0.1	0.24	0.13	0.43	<0.1	<0.1	0.25	<0.1	0.20	1.0	0.70	0.22
22:1	Mean	0.34	0	0	0	0.41	6.5	0.07	0	0	0.11	0	0.07	0.11	0.15	0
	Min	0.28	<0.1	<0.1	<0.1	0.30	5.5	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	0.10	<0.1	<0.1

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Median	0.36	<0.1	<0.1	<0.1	0.39	7.0	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	0.10	0.18	<0.1
	Max	0.37	<0.1	<0.1	<0.1	0.55	7.1	0.11	<0.1	<0.1	0.12	<0.1	0.10	0.14	0.24	<0.1
22:2 n-6	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0.07	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1
22:4 n-3	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22:4 n-6	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
22:5 n-3	Mean	0	0	0	0	0.24	0.96	0	0	0	0	0.07	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	0.21	0.82	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	0.24	0.95	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.27	1.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
22:5 n-6	Mean	0	0	0	0	0.15	0.13	0	0	0	0	0.08	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	0.13	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	0.14	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	0.17	0.15	<0.1	<0.1	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1
22:6 n-3	Mean	0	0	0	0	7.9	6.2	0	0	0	0	1.2	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	6.8	5.8	<0.1	<0.1	<0.1	<0.1	1.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	8.0	6.2	<0.1	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	9.0	6.5	<0.1	<0.1	<0.1	<0.1	1.3	<0.1	<0.1	<0.1	<0.1
23:0	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fatty acid		Cereal products	Pastries	Meat	*Processed meat*	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Fruits	Potatoes	Sugar and sweets
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
24:0	Mean	0	0	0	0	0	0	0.08	0	0	0	0	0	0.48	0.21	0.07
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.37	0.12	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.40	0.13	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	0.68	0.25	0.12
24:1 n-9	Mean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Min	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Median	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Max	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

< indicates a value below limit of quantification (LOQ=0.1%).

Individual fatty acids were not analysed the food groups subgroup pizza/hand pies, vegetables, beverages and coffee/tea

A5.2. Vitamins

The table presents concentrations of carotenoids, tocopherols, tocotrienols, and menaquinones in food groups in the Market Basket 2022 (N=3 samples per food group).

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
Lutein (µg/kg)	Mean	820	605	0*	0*	0*	737	0	0	126	1927	135	2407	615	207	52	0*
	Min	750	590				691	<50	<50	105	1770	80	2320	510	175	<50	
	Median	846	594				701	<50	<50	133	1880	87	2440	640	177	53	
	Max	864	631				818	<50	<50	141	2130	239	2460	696	269	78	
Lycopene (µg/kg)	Mean	0	3573	0*	0*	0*	169	0	0	0	0	833	18500	0	0	0	0*
	Min	<50	1540				124	<50	<50	<50	<50	525	15900	<50	<50	<50	
	Median	<50	4530				165	<50	<50	<50	<50	835	18800	<50	<50	<50	
	Max	<50	4650				218	<50	<50	<50	<50	1140	20800	<50	<50	<50	
Xeaxanthine (µg/kg)	Mean	102	52	0*	0*	0*	228	0	0	0	1008	0	259	164	0	0	0*
	Min	92	<50				149	<50	<50	<50	839	<50	165	131	<50	<50	
	Median	101	56				262	<50	<50	<50	1044	<50	303	175	<50	<50	
	Max	114	75				272	<50	<50	<50	1140	<50	310	187	<50	<50	
β-tocopherol (mg/kg)	Mean	1.7	1.9	0	0	0	0.57	0	0	0	1.2	0	0	0	0	0.27	0
	Min	1.7	1.6	<0.4	<0.4	<0.4	0.52	<0.4	<0.4	<0.4	0.86	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Median	1.7	1.9	<0.4	<0.4	<0.4	0.57	<0.4	<0.4	<0.4	1.1	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
	Max	1.9	2.2	<0.4	<0.4	<0.4	0.63	<0.4	<0.4	<0.4	1.5	<0.4	<0.4	<0.4	<0.4	0.42	<0.4
δ-tocopherol (mg/kg)	Mean	0	0.85	0	0	0.34	3.9	0	0	1.7	0.31	1.8	0	0.48	0	0.83	0
	Min	<0.4	0.57	<0.4	<0.4	<0.4	2.0	<0.4	<0.4	1.3	<0.4	1.4	<0.4	0.43	<0.4	0.67	<0.4

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
	Median	<0.4	0.72	<0.4	<0.4	<0.4	4.3	<0.4	<0.4	1.5	<0.4	1.5	<0.4	0.45	<0.4	0.79	<0.4
	Max	<0.4	1.3	<0.4	<0.4	0.61	5.4	<0.4	<0.4	2.3	0.53	2.4	<0.4	0.56	<0.4	1.0	<0.4
γ-tocopherol	Mean	4.5	20	0.68	3.7	19	27	0	0	11	6.8	126	2.0	3.0	0.30	8.6	0
(mg/kg)	Min	3.3	16	0.62	2.9	19	9.5	<0.4	<0.4	9.6	5.5	121	1.5	2.4	<0.4	6.8	<0.4
	Median	4.6	20	0.63	3.6	19	35	<0.4	<0.4	12	7.4	128	2.3	3.4	<0.4	9.1	<0.4
	Max	5.5	23	0.78	4.6	19	37	<0.4	<0.4	13	7.4	129	2.3	3.4	0.51	9.8	<0.4
α-tocotrienol	Mean	2.3	5.9	0.43	0	0	0	0	0	0.65	1.0	3.6	0	0	0	3.6	0
(mg/kg)	Min	1.6	4.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.52	0.73	2.9	<0.4	<0.4	<0.4	3.0	<0.4
	Median	2.4	6.0	0.46	<0.4	<0.4	<0.4	<0.4	<0.4	0.69	0.92	4.0	<0.4	<0.4	<0.4	3.2	<0.4
	Max	2.7	6.8	0.64	<0.4	<0.4	<0.4	<0.4	<0.4	0.75	1.3	4.1	<0.4	<0.4	<0.4	4.4	<0.4
β-tocotrienol	Mean	11.3	8.9	0	0.27	0	0.75	0	0	0	0.79	0.72	0	0	0	1.1	0
(mg/kg)	Min	11	8.3	<0.4	<0.4	<0.4	0.70	<0.4	<0.4	<0.4	0.67	0.55	<0.4	<0.4	<0.4	0.92	<0.4
	Median	11	9.1	<0.4	<0.4	<0.4	0.76	<0.4	<0.4	<0.4	0.77	0.72	<0.4	<0.4	<0.4	1.1	<0.4
	Max	12	9.4	<0.4	0.40	<0.4	0.78	<0.4	<0.4	<0.4	0.94	0.90	<0.4	<0.4	<0.4	1.2	<0.4
δ-tocotrienol	Mean	0	1.4	0	0	0	0	0.45	0	0	0	0.35	0	0.39	0	2.2	0
(mg/kg)	Min	<0.4	1.0	<0.4	<0.4	<0.4	<0.4	0.42	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	1.9	<0.4
	Median	<0.4	1.3	<0.4	<0.4	<0.4	<0.4	0.45	<0.4	<0.4	<0.4	0.43	<0.4	0.45	<0.4	2.3	<0.4
	Max	<0.4	1.8	<0.4	<0.4	<0.4	<0.4	0.49	<0.4	<0.4	<0.4	0.43	<0.4	0.52	<0.4	2.5	<0.4
γ-tocotrienol	Mean	0.61	8.4	0.98	0	0	1.1	0	0	0	0	5.2	0.30	0.39	0	7.7	0
(mg/kg)	Min	0.54	6.1	0.53	<0.4	<0.4	0.84	<0.4	<0.4	<0.4	<0.4	3.9	<0.4	<0.4	<0.4	6.2	<0.4
	Median	0.64	8.5	0.89	<0.4	<0.4	1.2	<0.4	<0.4	<0.4	<0.4	5.6	<0.4	<0.4	<0.4	7.1	<0.4
	Max	0.65	11	1.5	<0.4	<0.4	1.3	<0.4	<0.4	<0.4	<0.4	5.9	0.51	0.76	<0.4	10	<0.4
Menaquinone-7	Mean	NA	NA	NA	NA	NA	NA	NA	6.8	NA	NA	NA	NA	NA	NA	NA	NA
(µg/kg)	Min								<10								
	Median								<10								
	Max								10								
Menaquinone-8	Mean	NA	NA	NA	NA	NA	NA	NA	55	NA	NA	NA	NA	NA	NA	NA	NA

		Cereal products	Pastries	Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils	Vegetables	Fruits	Potatoes	Sugar and sweets	Beverages
(µg/kg)	Min								50								
	Median								57								
	Max								57								
Menaquinone-9 (µg/kg)	Mean	NA	NA	NA	NA	NA	NA	<10	168	NA	<10	NA	NA	NA	NA	NA	NA
	Min							<10	155		<10						
	Median							<10	172		<10						
	Max							<10	176		<10						

1 g/kg = 0.1 g/100 g. NA, not analyzed.

0*, content was assumed to be logical zero and no analyses were performed.

< indicates a value below limit of quantification (LOQ). When calculating means as well as concentrations of vitamin A, D and K, medium bound concentration (0.5*LOQ) was imputed for non-detects, with exception for when all three samples in one food group had concentrations of an element below LOQ. In those cases, lower bound (0) was imputed for non-detects when calculation mean.

No analyses were performed in the food groups subgroup pizza/hand pies, and coffee/tea.

A5.3. PCBs and dioxins

The table presents concentrations of PCBs, PCDDs and PCDFs in food groups (fresh weight basis) in the Market Basket 2022 (N=3 samples per food group).

Compound		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
CB 28 (ng/g)	Min	<0.004	<0.01	0.091	<0.01	<0.0003	<0.01	<0.0002	<0.01	<0.04
	Median	<0.004	<0.01	0.110	<0.01	<0.0003	<0.02	<0.0004	<0.01	<0.05
	Max	<0.01	<0.01	0.110	<0.01	<0.0003	<0.02	<0.0004	<0.01	<0.05
CB 52 (ng/g)	Min	<0.004	<0.01	0.240	<0.01	<0.0003	<0.01	<0.0004	<0.004	<0.02
	Median	<0.004	<0.01	0.260	<0.01	<0.0004	<0.01	<0.0004	<0.004	<0.02
	Max	<0.004	0.016	0.310	<0.01	<0.0004	<0.01	<0.001	<0.005	<0.03
CB 101 (ng/g)	Min	<0.004	<0.02	0.360	<0.004	<0.0002	<0.01	<0.0003	<0.005	<0.01
	Median	<0.01	0.020	0.420	<0.004	<0.0003	<0.01	<0.0003	<0.006	<0.01
	Max	<0.01	0.024	0.550	<0.004	<0.0004	<0.01	<0.001	0.007	0.016
CB 138 (ng/g)	Min	0.018	0.015	0.360	<0.003	0.002	0.036	<0.00001	0.024	0.025
	Median	0.021	0.026	0.500	<0.004	0.002	0.044	<0.00002	0.025	0.031
	Max	0.021	0.029	0.640	<0.01	0.003	0.046	<0.0001	0.034	0.035
CB 153 (ng/g)	Min	0.026	0.027	0.660	<0.003	0.003	0.043	<0.0002	0.037	0.027
	Median	0.032	0.044	0.860	<0.005	0.003	0.054	<0.0003	0.042	0.049
	Max	0.033	0.045	1.05	<0.01	0.004	0.061	<0.0004	0.053	0.052
CB 180 (ng/g)	Min	0.012	0.007	0.170	0.001	0.001	0.017	<0.00001	0.010	0.011
	Median	0.012	0.009	0.210	0.008	0.001	0.021	<0.0001	0.012	0.024
	Max	0.013	0.011	0.260	0.020	0.001	0.022	<0.0002	0.015	0.047
CB 77 (pg/g)	Min	<0.19	<0.36	4.26	<0.25	0.043	<0.56	<0.03	<0.45	<0.91
	Median	<0.21	<0.44	5.43	<0.36	0.057	<0.56	0.033	<0.47	<0.95
	Max	<0.22	<0.45	5.43	<0.38	0.057	<0.66	0.058	<0.67	<1.4
CB 81 (pg/g)	Min	<0.003	0.016	0.180	<0.003	0.002	0.044	<0.001	<0.03	<0.06
	Median	<0.01	0.028	0.250	<0.003	0.002	0.052	0.001	<0.03	<0.06

Compound		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
	Max	0.016	0.028	0.260	<0.005	0.002	0.055	0.002	<0.03	<0.07
CB 105 (pg/g)	Min	<1.7	4.22	70.9	<1.2	0.250	<5.7	<0.05	5.90	<5.2
	Median	<2.0	6.79	92.5	<1.2	0.260	<5.7	<0.06	5.91	<5.8
	Max	<2.2	8.55	137	<1.3	0.280	<7.2	<0.11	6.01	<5.8
CB 114 (pg/g)	Min	0.170	<0.09	4.23	<0.04	<0.02	0.340	<0.03	0.350	<0.52
	Median	0.220	0.300	5.90	<0.13	<0.03	0.420	<0.03	0.370	0.510
	Max	0.240	0.400	8.84	0.082	<0.03	0.460	<0.04	0.430	0.610
CB 118 (pg/g)	Min	<7.6	14.2	261	<2.3	1.20	19.9	<0.14	18.3	<19
	Median	9.42	21.9	335	<2.7	1.23	23.5	<0.23	18.6	<19
	Max	10.8	24.4	498	<3.0	1.41	25.8	<0.29	21.1	<23
CB 123 (pg/g)	Min	<1.6	<1.05	<7.4	<0.52	<0.15	<1.0	<0.23	<0.85	<3.1
	Median	<2.1	<2.0	<10	<0.63	<0.22	<1.1	<0.24	<0.90	<3.2
	Max	<2.2	<2.3	<10	<0.64	<0.23	<1.4	<0.25	<1.0	<3.7
CB 126 (pg/g)	Min	0.100	0.084	1.59	<0.01	0.019	0.330	<0.006	0.120	0.190
	Median	0.120	0.150	1.91	<0.02	0.022	0.350	<0.007	0.120	0.260
	Max	0.130	0.160	2.53	<0.02	0.023	0.360	<0.01	0.250	0.340
CB 156 (pg/g)	Min	1.62	1.01	22.1	<0.23	0.200	2.53	<0.004	1.53	1.84
	Median	1.78	1.87	28.3	<0.30	0.210	3.41	<0.005	1.77	2.74
	Max	1.80	2.22	44.4	<0.46	0.240	3.59	<0.03	2.59	3.45
CB 157 (pg/g)	Min	0.280	0.250	7.34	<0.04	0.028	0.420	<0.002	0.350	<0.12
	Median	0.340	0.600	9.51	<0.04	0.040	0.570	<0.003	0.440	0.220
	Max	0.380	0.610	12.9	<0.07	0.046	0.580	<0.005	0.490	0.540
CB 167 (pg/g)	Min	0.760	0.690	17.1	<0.13	0.110	1.68	<0.004	0.950	0.890
	Median	0.830	1.31	23.8	<0.29	0.120	1.96	<0.005	1.04	1.64
	Max	0.960	1.45	28.2	<0.51	0.120	2.07	0.012	1.60	1.97
CB 169 (pg/g)	Min	0.020	<0.003	0.420	<0.002	0.002	0.049	<0.0003	0.033	0.026
	Median	0.026	0.030	0.490	<0.002	0.003	0.053	<0.0003	0.037	0.034
	Max	0.027	0.047	0.610	<0.003	0.004	0.055	<0.0004	0.047	0.043

Compound		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
CB 189	Min	0.170	0.110	2.81	<0.003	<0.02	0.320	<0.001	0.150	0.097
(pg/g)	Median	0.170	0.170	3.39	<0.02	<0.02	0.410	<0.003	0.180	0.310
	Max	0.210	0.220	4.27	0.076	<0.03	0.470	<0.004	0.280	0.410
1,2,3,4,6,7,8-HpCDD	Min	<0.02	<0.01	<0.04	<0.01	<0.001	0.097	<0.001	<0.02	<0.08
(pg/g)	Median	<0.02	<0.01	<0.05	<0.01	<0.001	0.110	<0.001	<0.02	<0.08
	Max	0.015	<0.02	0.041	0.033	0.001	0.140	<0.002	<0.02	<0.10
1,2,3,4,7,8-HxCDD	Min	<0.002	<0.002	<0.01	<0.002	<0.001	<0.005	<0.0004	<0.002	0.010
(pg/g)	Median	<0.002	<0.002	<0.01	<0.003	<0.0003	0.014	<0.0004	<0.002	0.011
	Max	<0.002	<0.004	<0.01	<0.004	<0.0003	0.028	<0.001	0.003	0.027
1,2,3,6,7,8-HxCDD	Min	<0.002	<0.002	<0.01	<0.002	<0.0003	<0.005	<0.0004	0.004	0.023
(pg/g)	Median	0.004	<0.002	<0.01	<0.002	0.001	0.020	<0.0004	0.007	0.026
	Max	0.005	<0.003	<0.01	<0.004	0.001	0.032	<0.001	0.010	0.028
1,2,3,7,8,9-HxCDD	Min	<0.002	<0.002	<0.01	<0.003	<0.0004	<0.01	<0.0005	0.003	<0.01
(pg/g)	Median	<0.002	<0.002	<0.01	<0.003	0.0004	<0.01	<0.001	0.004	0.022
	Max	<0.002	<0.004	<0.01	<0.004	0.001	0.014	<0.001	0.006	0.029
1,2,3,7,8-PeCDD	Min	<0.004	<0.004	<0.02	<0.005	<0.001	<0.01	<0.001	<0.004	<0.02
(pg/g)	Median	<0.005	<0.004	<0.03	<0.008	<0.001	<0.02	<0.001	<0.007	<0.02
	Max	<0.01	<0.01	<0.03	<0.01	<0.001	0.051	<0.001	0.005	0.054
2,3,7,8-TCDD	Min	<0.002	<0.002	<0.01	<0.002	<0.0002	<0.01	<0.0003	0.004	<0.01
(pg/g)	Median	<0.003	<0.002	<0.01	<0.002	<0.0003	<0.01	<0.0004	0.004	<0.01
	Max	<0.003	<0.003	<0.01	<0.003	<0.0003	0.007	<0.001	0.004	<0.02
OCDD	Min	<0.05	<0.03	<0.10	<0.13	<0.002	<0.32	<0.001	<0.07	<0.61
(pg/g)	Median	<0.06	<0.03	<0.12	<0.14	<0.002	<0.49	0.013	<0.07	<0.83
	Max	<0.06	<0.09	<0.13	<0.26	0.006	<0.50	0.035	<0.08	<0.86
1,2,3,4,6,7,8-HpCDF	Min	<0.02	<0.01	<0.10	<0.02	<0.0001	<0.07	<0.0001	0.009	0.032
(pg/g)	Median	<0.02	<0.01	<0.13	<0.02	<0.0001	<0.18	<0.0002	0.009	0.210
	Max	<0.03	<0.01	<0.14	<0.03	0.0004	0.220	0.001	0.060	0.230
1,2,3,4,7,8,9-HpCDF	Min	<0.001	<0.001	<0.01	<0.002	<0.0001	0.012	<0.0002	0.003	0.041

Compound		Meat	Lean fish	Fatty fish	Meat substitutes	Lean dairy products	Fatty dairy products	Plant-based drinks	Eggs	Fats and oils
(pg/g)	Median	<0.002	<0.003	<0.03	<0.003	<0.0001	0.038	<0.0002	0.009	0.041
	Max	<0.002	<0.004	<0.03	<0.006	<0.0002	0.045	<0.0002	0.015	0.052
1,2,3,4,7,8-HxCDF	Min	<0.01	<0.005	0.056	<0.004	<0.001	<0.04	<0.001	0.005	<0.02
(pg/g)	Median	0.012	0.007	0.061	<0.01	<0.001	0.120	<0.001	0.007	0.150
	Max	0.020	0.010	0.077	<0.01	<0.001	0.150	<0.001	0.033	0.190
1,2,3,6,7,8-HxCDF	Min	<0.01	<0.005	0.053	<0.004	<0.001	0.030	<0.001	0.003	<0.02
(pg/g)	Median	<0.01	<0.01	0.060	0.007	<0.001	0.065	<0.001	0.007	0.089
	Max	0.011	<0.01	0.063	0.011	<0.001	0.075	<0.001	0.026	0.092
1,2,3,7,8,9-HxCDF	Min	<0.01	<0.01	<0.03	<0.007	<0.001	<0.01	<0.001	<0.004	<0.02
(pg/g)	Median	<0.01	<0.01	<0.03	<0.01	<0.001	0.030	<0.001	0.008	<0.03
	Max	<0.01	<0.01	<0.04	0.007	<0.001	0.042	<0.001	0.010	0.047
1,2,3,7,8-PeCDF	Min	<0.01	<0.005	<0.05	<0.007	<0.001	<0.01	<0.002	0.006	<0.02
(pg/g)	Median	<0.01	<0.01	0.067	<0.01	<0.001	0.080	<0.002	0.008	0.074
	Max	<0.01	<0.01	0.072	0.016	<0.001	0.110	<0.002	0.026	0.100
2,3,4,6,7,8-HxCDF	Min	<0.01	<0.005	<0.02	<0.005	<0.001	0.013	<0.001	0.005	<0.02
(pg/g)	Median	<0.01	<0.005	<0.03	<0.005	<0.001	0.039	<0.001	0.009	0.030
	Max	<0.01	<0.01	0.025	0.005	<0.001	0.049	<0.001	0.010	0.042
2,3,4,7,8-PeCDF	Min	<0.01	<0.005	0.110	<0.004	<0.001	<0.01	<0.002	0.008	0.037
(pg/g)	Median	0.010	<0.01	0.120	<0.005	<0.001	<0.01	<0.002	0.008	0.042
	Max	0.010	<0.01	0.130	<0.006	0.001	0.049	<0.002	0.013	0.058
2,3,7,8-TCDF	Min	<0.003	<0.02	0.300	0.004	<0.001	0.047	<0.001	<0.04	<0.11
(pg/g)	Median	<0.004	<0.03	0.320	0.012	<0.001	0.078	<0.001	<0.04	<0.13
	Max	<0.01	0.036	0.400	0.016	<0.001	0.110	<0.001	<0.05	<0.2
OCDF	Min	<0.01	<0.01	<0.07	<0.04	<0.0003	<0.17	<0.0004	<0.007	<0.04
(pg/g)	Median	<0.01	<0.01	<0.08	<0.06	<0.0003	<0.20	<0.001	<0.01	0.18
	Max	<0.02	<0.03	<0.09	<0.06	<0.0003	<0.27	0.001	0.037	0.20

Livsmedelsverket