Contents of total fat, fatty acids, starch, sugars and dietary fibre in Swedish market basket diets

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(Submitted 22 September 2014 – Final revision received 19 December 2014 – Accepted 2 February 2015 – First published online 2 April 2015)

Abstract
The typical dietary supply of total fat, fatty acids, starch, sugars, polyols and dietary fibre in Sweden was assessed from analyses of market baskets (MB) purchased in 2005 and 2010. MB were based on food balance sheets, with each basket comprising about 130 foods, which represented more than 90% of annual dietary supply. Foods were divided into ten to twelve categories. In 2010, total fat contributed 34% of energy (E%), SFA 14·3 E%, MUFA 12·8 E%, PUFA 4·6 E%, n-6 fatty acids 3·6 E%, n-3 fatty acids 1·0 E% and trans-fatty acids (TFA) 0·5 E%. Glycaemic carbohydrates contributed 47 E%, monosaccharides 9 E%, sucrose 11 E%, disaccharides 15 E% and total sugars 24 E%. Added sugars contributed about 1·7 g/MJ in the 2010 MB. Compared with the 2005 MB, the dietary supply of TFA and dietary fibre was lower, otherwise differences were small. The present MB survey shows that the content of SFA and added sugars was higher than the current Nordic Nutrition Recommendations, while the content of PUFA and especially dietary fibre was lower. TFA levels decreased and dietary supply was well below the recommendations of the WHO. These results emphasise a focus on quality and food sources of fat and carbohydrates, limiting foods rich in SFA and added sugars and replacing them with foods rich in dietary fibre and cis-unsaturated fatty acids.

Key words: Market baskets; Fat; Fatty acids; Starch; Sugars; Polyols; Dietary fibre; Sweden

Data on dietary intakes of nutrients are generally obtained from dietary surveys using various assessment methods. The range of nutrients that can be assessed is limited by the available food composition database. Dietary carbohydrates comprise a range of constituents including starch, mono- and disaccharides, as well as polyols and dietary fibre. The coverage of these constituents of carbohydrates in food composition databases is often limited, leading to uncertainties in dietary exposure assessments from dietary surveys. The same applies for various fatty acids, e.g. trans-fatty acid (TFA) isomers and some long-chain PUFA. Other complementary approaches are market basket (MB) and total diet studies, which are used to estimate the average dietary exposure to various dietary components, especially minerals and contaminants. The purpose of the present study was to describe the content of total fat, fatty acids and carbohydrate constituents in Sweden using analytical data from MB. The results of the analysis are compared with calculations that are based on Swedish food composition database and food consumption surveys. Previously, the MB approach has been used in Sweden to assess dietary exposure to essential mineral elements and contaminants such as heavy metals, halogenated hydrocarbons and radionuclides.

Materials and methods
Market baskets
The choice of food items included in the MB was based on food balance sheets (FBS) that are managed by the Swedish Board of Agriculture (SBA). Food consumption data for the 2005 MB were based on the FBS for 2003, and on the 2007 FBS for the 2010 MB. FBS give information on annual market availability of food categories and foodstuffs. Supplementary purchase statistics for fish and fats (for 2009/2010) were obtained from the market research company Growth from Knowledge, Sweden. This is due to the lack of detailed data on fresh fish and fats in the SBA report. The Growth from Knowledge statistics are based on their consumer panels, and can be transformed into values representing the total consumption volume (in kg) and representing some of the leading products and specific types or products of fish.

A shopping list was produced by breaking down the food categories into food items using data for their market shares (see online Supplementary Table S1). Food categories were included based on their average consumption of 0·5 kg/person per year (i.e. 1·5 g/person per d) or more. The list covers

Abbreviations: E%, percentage of energy; FBS, food balance sheet; MB, market basket; NFA, National Food Agency; NMKL, Nordic Committee on Food Analysis; SBA, Swedish Board of Agriculture; TFA, trans-fatty acids.

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approximately 90% of the total annual consumption expressed in kg/person. For each food category, one or more individual food items were selected depending on the level of detail in the statistics. For food categories such as wheat flour, milk, butter, eggs, tomatoes and oranges, one sample was generally purchased. For food categories comprising mixed foods such as bread, pastries, sausages, fat spreads and oils, and vegetable and fruit preserves, several products/brands were purchased in relation to consumption. This means that each basket represents more than 130 food items. Foods excluded were coffee and tea, tap water, household salt and alcoholic beverages. Beer with <3.5 vol% alcohol, which is available in regular food stores, was included.

In August–December 2005, food baskets were obtained from two major department stores in each of four larger Swedish cities (Malmö, Gothenburg, Uppsala and Sundsvall), representing different regions and major populations areas(7,9). Thus, the total number of baskets was eight. Due to practical reasons and similar product/brand assortment, ice cream and fats were purchased in Uppsala only. An evaluation of the results from these surveys showed in most cases no significant and consistent differences between food baskets from these cities, and for the 2010 MB, food baskets were collected from Uppsala only. The Uppsala baskets were collected from five different major grocery chains (Coop, ICA, Willys, Hemköp and Lidl). The purchases were all made in May–June 2010, plus a supplementary purchase of fruit, vegetables and potatoes was made in the autumn of the same year (September–October) with the purpose of obtaining more Swedish-grown products. Due to the delay in obtaining consumption data on fish products, sampling of this food group was postponed and synchronised with vegetables (September–October). One objective of food sampling in 2010 was to examine the possible differences between standard-price and low-price products. Based on this approach two food baskets were collected at each food chain: one standard-price and one low-price basket. For one of the food chains (Lidl), only one basket was collected because of a limited selection of food items within each food group. A total of nine different food baskets were collected from these Uppsala food stores during spring 2010, and five supplementary purchases of vegetables, fruits and potatoes (of what was defined as being in the standard-price category) were made from these food chains in the autumn of the same year.

In 2005, staff from the local health authorities in each city made the purchases, except in Uppsala where staff from the National Food Agency (NFA) made the purchase. In the 2005 MB, each shopper was instructed to take advantage of normal-price with low-price alternatives. Immediately after the purchase, the baskets were transported to the NFA in Uppsala. In both studies, more than 1000 food items were purchased.

### Preparation of food samples

Food items in each basket were divided into twelve groups, of which ten were analysed for carbohydrates (Table 1). Grouping is based on the categorisation in the Swedish Food Circle (vegetables, fruit, potatoes, bread/cereals, dairy products, meat, fish, eggs and fats) in combination with categories defined in the SBA statistics (sweet bakery products, sugar/sweets and beverages). Food groups not contributing to carbohydrate intake

| Food groups | Description of food items included in the food group |
|-------------|--------------------------------------------------|
| Cereals     | Flour, grains, breakfast cereals, pasta and bread |
| Pastries    | Biscuits, buns and cakes                          |
| Meat        | Beef, pork, lamb, poultry and cured/processed meats |
| Fish        | Fresh and frozen, canned products and shellfish  |
| Dairy products | Milk, sour milk, yogurt, cream, hard cheese, processed cheese and cottage cheese |
| Eggs        | Fresh eggs                                        |
| Fats        | Butter, spreads, cooking oil and mayonnaise       |
| Vegetables, including root vegetables | Fresh and frozen, canned products and shellfish |
| Fruit and berries | Fresh and frozen, canned products, juice, nuts, cordials and jam |
| Potatoes    | Fresh, French fries, mashed potato powder and crisps |
| Sweets, sugar, ice cream | Chocolate, sugar-based sweets, dairy and vegetable fat-based ice cream, sugar, mustard and ketchup (<3.5 vol% alcohol) |
| Beverages   | Soft drinks, mineral water and beer (<3.5 vol% alcohol) |

* Represent a specific food item or category, e.g. white bread and herring. Several categories are mixed samples (two or more brands/types of the same category).
Chemical analyses

Fat and fatty acids

2010. Total fat was analysed in all food groups, except beverages (i.e. twenty-two samples), by accredited gravimetric standard methods. Fat in dairy products, fats, and sugar and sweets was analysed by the Röse–Gottlieb method according to the Nordic Committee on Food Analysis (NMKL)\(^1\), and in cereal products, pastries, meat, fish, eggs, vegetables, fruits and potatoes by the Schmidt–Bondzynski–Ratzlaff (SBR) method according to the NMKL\(^2\). Fatty acids were analysed in all food groups except beverages by an in-house validated and accredited method. Fat was extracted according to the method of Folch et al.\(^3\). Fatty acids in the fat were converted to methyl esters and separated on a capillary column. Reference standards containing individual SFA, MUFA and PUFA were used for identification\(^4\). TFA were analysed according to an American Oil Chemists’ Society standard method\(^5\) by GC using a 100 m HP-88 capillary column for separation. The limit of detection was 0.03 % for each fatty acid. Analyses were performed in March 2011 (total fat) and August 2011 (fatty acids).

2005. Total fat in the homogenates of cereals, pastries, vegetables, potatoes and fruit was analysed as raw fat according to EC-directive 98/64/EC\(^6\). Total fat was analysed by the National Veterinary Institute, Uppsala, and fatty acids at NFA. Starch was determined enzymatically by a NMKL method\(^7\). Analyses were carried out in February 2008. Mono- and disaccharides (glucose, fructose, sucrose, lactose and maltose) and polyols (xylitol and sorbitol) were determined by GLC using an in-house, validated method\(^8\). Carbohydrates were converted to trimethylsilyl ethers after extraction with 80 % ethanol and analysed by GLC using flame ionisation detection, followed by quantification using a calibration curve with phenyl-β-D-glucoside as the internal standard. The analyses were carried out in November–December 2007. Total dietary fibre content was determined gravimetrically according to the Association of Official Analytical Chemists/ NMKL\(^9\). Samples were treated with the enzymes Termamyl\(^10\), protease and amyloglucosidase, filtered, washed, dried and weighed. Total dietary fibre was then determined gravimetrically as the remainder after correction for protein and ash weight. The analyses were carried out in November–December 2006.

The analyses of starch, sugars and polyols were performed at NFA, while analyses of dietary fibre were done by Eurofins Food Agro, Lidköping.

Analytical quality control

The laboratories are accredited for the use of the aforementioned methods.

Calculation of daily supply

The average daily supply of individual nutritional components of each food group was calculated by multiplying the concentration by the amount representing daily consumption according to the statistics.

Results

Fat and fatty acids in the food groups

The concentrations of major fatty acid categories in the food groups are given in Table 2. The proportion of SFA was highest in dairy products, sugar and sweets, pastries, and meat. TFA concentrations were generally below 1 % of total fatty acids, with the exception of dairy products, meat and fats. The proportion of PUFA was highest in vegetables, cereal products and fish. The proportion of n-3 fatty acids was highest in fish, while the proportion of n-6 fatty acids (mainly linoleic acid) was highest in cereal products and vegetables.

There were generally small differences between the 2005 and 2010 MB, although TFA levels in pastries were lower in 2010 than in 2005 (Table 2). The fat content in the fish group was higher, which can be mainly attributed to a large proportion of salmon. In the 2005 MB, variation between the cities was generally moderate, with CV being 10–20 % or less. Large ranges were observed for TFA, for example, in pastries.
Table 2. Content of total fat (g/100 g food) and major fatty acid categories (g/100 g fatty acids) in the food groups included in market baskets purchased in 2005 and 2010
(Mean values and ranges)

| Food groups      | Year | Mean | Range   | Mean | Range   | Mean | Range   | Mean | Range   | Mean | Range   |
|------------------|------|------|---------|------|---------|------|---------|------|---------|------|---------|
|                   |      | Total fat | SFA | MUFA | PUFA | TFA | n-6 | n-3 |
|                   |      |          |      |      |      |     |     |     |
| Cereals           |      | 2005     | 2.6 | 1.7–3.4 | 18.1 | 15.1–22.0 | 38.7 | 33.0–46.2 | 43.0 | 38.5–49.0 | 0.2 | 0–0.6 |
|                   |      | 2010     | 2.2 | 2.2–2.2 | 19.0 | 16.9–21.0 | 39.7 | 38.6–40.8 | 41.2 | 40.1–42.3 | 0.37 | 0.34–0.39 |
| Pastries          |      | 2005     | 17.9 | 16–19.4 | 48.8 | 43.8–53.8 | 36.6 | 33.5–40.4 | 14.6 | 12.0–17.1 | 2.7 | 0.6–6.4 |
|                   |      | 2010     | 20.0 | 19.6–20.4 | 46.7 | 45.2–48.3 | 39.1 | 37.9–40.3 | 14.0 | 13.6–14.4 | 0.78 | 0.66–0.89 |
| Meat              |      | 2005     | 13.6 | 12.0–15.0 | 40.1 | 37.6–41.1 | 49.1 | 47.7–51.3 | 10.2 | 9.3–10.6 | 1.3 | 1.0–1.5 |
|                   |      | 2010     | 11.9 | 11.8–12.0 | 41.4 | 40.8–42.1 | 48.7 | 48.7–48.8 | 8.8 | 8.4–9.1 | 1.5 | 1.3–1.65 |
| Fish              |      | 2005     | 8.8 | 6.6–10.0 | 16.9 | 16.2–17.7 | 46.4 | 44.5–48.2 | 35.0 | 34.3–36.2 | 1.1 | 0.8–1.6 |
|                   |      | 2010     | 11.5 | 10.9–12.1 | 15.8 | 15.5–16.1 | 49.9 | 49.7–50.0 | 33.9 | 33.8–34.0 | 0.82 | 0.80–0.83 |
| Dairy products    |      | 2005     | 5.4 | 4.4–6.6 | 67.9 | 64.8–70.6 | 26.2 | 24.4–28.4 | 5.1 | 4.1–5.9 | 4.0 | 3.4–4.7 |
|                   |      | 2010     | 5.1 | 5.0–5.1 | 66.5 | 66.4–66.6 | 26.8 | 26.6–27.1 | 4.1 | 4.0–4.2 | 4.2 | 4.1–4.2 |
| Eggs              |      | 2005     | 7.9 | 7.9–7.9 | 32.1 | 31.2–33.1 | 51.4 | 50.3–52.9 | 16.2 | 15.1–17.9 | 0.8 | 0.8–1.0 |
|                   |      | 2010     | 9.5 | 9.4–9.5 | 32.8 | 32.7–33.0 | 49.5 | 49.3–49.7 | 17.5 | 17.4–17.5 | 0.27 | 0.25–0.29 |
| Fats              |      | 2005     | 67.3 | 37.2 | 43.3 | 19.5 | 14.4 | 5.0 |
|                   |      | 2010     | 66.7 | 38.0 | 41.8 | 19.7 | 14.9 | 4.5 |
| Vegetables, roots |      | 2005     | 0.4 | 0.2–0.5 | 27.0 | 26.1–27.6 | 13.7 | 11.9–18.1 | 57.3 | 52.2–59.7 | 0.4 | 0.4–0.5 |
|                   |      | 2010     | 0.2 | 0.2–0.2 | 27.1 | 25.9–26.4 | 16.0 | 14.9–17.2 | 54.9 | 53.0–56.9 | 0.46 | 0.44–0.48 |
| Fruit and berries |      | 2005     | 0.6 | 0.5–0.6 | 11.4 | 10.7–12.6 | 72.0 | 65.9–74.7 | 14.9 | 13.0–18.0 | 0.1 | 0.0–0.3 |
|                   |      | 2010     | 1.05 | 0.9–1.2 | 10.1 | 9.9–10.3 | 77.3 | 77.1–77.5 | 11.7 | 11.5–12.0 | – | 10.9 | 10.6–11.1 | 0.9 | 0.88–0.91 |
| Potatoes          |      | 2005     | 2.5 | 2.0–2.8 | 47.7 | 45.0–49.5 | 42.0 | 41.0–44.6 | 10.2 | 9.5–11.2 | 0.2 | 0–0.4 |
|                   |      | 2010     | 1.9 | 1.7–2.1 | 30.9 | 26.9–34.8 | 58.8 | 57.2–60.3 | 10.2 | 7.8–12.5 | 0.3 | 0.3–0.38 |
| Sweets, ice cream, sugar | | 2005     | 2.9 | 2.1–4.1 | 60.3 | 53.8–63.3 | 33.2 | 31.8–37.1 | 6.3 | 4.6–9.2 | 0.3 | 0–0.8 |
|                   |      | 2010     | 11.8 | 11.5–12.1 | 50.6 | 50.5–50.8 | 38.6 | 38.1–39.1 | 10.8 | 10.5–11.0 | 0.5 | 0.46–0.49 |

TFA, trans-fatty acids.
| Food groups     | Starch Mean | Range | Dietary fibre Mean | Range | Fructose Mean | Range | Glucose Mean | Range | Sucrose Mean | Range | Lactose Mean | Range | Maltose Mean | Range | Sorbitol Mean | Range |
|----------------|-------------|-------|-------------------|-------|---------------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|-------|
| **Cereals**    |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 48.4        | 47.5–49.9 | 5.5               | 4.9–6.0 | 1.2           | 0.7–1.8 | 1.2           | 1.0–1.7 | 0.3           | 0.29–0.47 | 0.2           | 0.20–0.32 | 2.6           | 2.1–3.2 | ND           |       |
| 2010           | 46.8        | 45.8–47.7 | 4.1               | 3.1–5.0 | 1.3           | 1.2–1.3 | 1.1           | 1.1–1.2 | 0.3           | 0.29–0.36 | 0.2           | 0.21–0.21 | 2.0           | 2.0–2.1 | NA           |       |
| **Pastries**   |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 25.0        | 22.3–26.2 | 2.9               | 2.6–3.2 | 1.4           | 1.1–2.0 | 2.2           | 1.8–2.9 | 19.3          | 18.3–20.3 | 0.3           | 0–0.83   | 1.1           | 0.74–1.8 | ND           |       |
| 2010           | 25.0        | 23.9–26.1 | 2.5               | 2.3–2.7 | 1.1           | 1.0–1.1 | 1.4           | 1.2–1.5 | 21.7          | 20.2–23.1 | ND           | 0.8       | 0.69–0.83     |       |
| **Dairy**      |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | ND          | NA    | <0.1              |       | 0.2           | 0.16–0.25 | 0.25          | 0.19–0.33 | 3.6           | 3.4–3.9   | NA           | ND        | ND           |       |
| 2010           | ND          | NA    | ND                |       | 0.1           | 0.12–0.14 | 0.4           | 0.38–0.41 | 3.5           | 3.2–3.8   | NA           | NA        | NA           |       |
| **Meat**       |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 1.3         | 1.1–1.3 | <1                |       | 0.1           | 0.07–0.12 | 0.6           | 0.51–0.62 | 0.3           | 0.24–0.35 | 0.2           | 0.12–0.36 | 0.2           | 0.16–0.18 | ND           |
| 2010           | 1.3         | 1.0–1.6 | NA                |       | <0.1          | 0.6      | 0.57–0.64     | 0.2     | 0.16–0.21    | 0.1     | 0.03–0.16    | 0.4     | 0.28–0.42    | ND       |
| **Fish**       |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 1.4         | 1.2–1.4 | NA                | <0.1  | 0.3           | 0.18–0.42 | 2.3           | 2.1–2.6 | 0.1           | 0.12–0.15 | 0.2           | 0.08–0.30 | ND           |       |
| 2010           | 1.6         | 1.5–1.6 | NA                | <0.1  | 0.2           | 0.14–0.17 | 2.0           | 1.9–2.1 | <0.1          |         | 0.3           | 0.22–0.29 | NA           |       |
| **Vegetables** |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 0.3         | 0.24–0.36 | 2.0          | 1.8–2.4 | 1.8           | 1.6–1.9 | 1.8           | 1.8–1.9 | ND           |         | ND           | 0.1     | 0.09–0.11    | ND       |
| 2010           | 0.4         | 0.33–0.51 | 1.9          | 1.7–2.1 | 2.1           | 2.0–2.3 | 1.8           | 1.8–1.9 | ND           |         | ND           | 0.1     | 0.10–0.12    | NA       |
| **Fruit and berries** |     |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 0.5         | <0.05–0.90 | 1.7        | 1.5–1.9 | 8.8           | 7.7–10.2 | 8.7           | 7.5–9.4 | 1.9           | 1.2–2.7  | ND           | 0.4     | 0.20–0.58    | 0.5     | 0.41–0.61    | ND       |
| 2010           | 0.2         | ND–0.45  | 1.7           | 1.6–1.7 | 7.4           | 6.8–8.1 | 6.3           | 5.8–6.8 | 5.2           | 5.1–5.4  | ND           | 0.2     | 0.14–0.22    | –        |
| **Potatoes**   |             |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 17.5        | 15.0–19.9 | 2.4         | 2.1–2.9 | 0.5           | 0.37–0.51 | 0.6           | 0.52–0.68 | <0.1          |         | ND           | 0.1     | 0.08–0.19    | ND       |
| 2010           | 15.8        | 15.7–15.8 | 2.2         | 1.9–2.4 | 0.3           | 0.20–0.48 | 0.4           | 0.29–0.46 | 0.2           | 0.05–0.26 | ND           | 0.1     | 0.11–0.13    | NA       |
| **Sweets, ice cream** |       |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | 4.8         | 3.7–7.1  | NA            | 1.8     | 1.1–2.6 | 4.2           | 3.7–5.0 | 48.3          | 47.8–48.6 | 2.6           | 2.4–2.8  | 2.5           | 2.2–3.0 | 0.1           | ND–0.29 |
| 2010           | 3.0         | 2.5–3.5  | NA            | 2.0     | 2.0–2.1 | 3.8           | 3.5–4.1 | 38.1          | 37.6–38.6 | 2.1           | 2.0–2.2  | 1.1           | 1.0–1.1 | NA           |       |
| **Soft drinks, beer** |      |       |                   |       |               |       |              |       |              |       |              |       |              |       |               |       |
| 2005           | NA          | NA      | 0.9           | 0.56–1.2 | 1.1           | 0.65–1.4 | 3.1           | 1.5–3.7 | ND           |         | ND           | ND      | ND           |         |
| 2010           | NA          | NA      | 1.1           | 0.94     | 4.1           |         | ND           |         | ND           |         | ND           | ND      | ND           |         |

ND, not detected (<0.05 g/100 g); NA, not analysed.
Of the sixty fatty acids included in the standard assay, only a few were not detected in each MB (15:1, 16:0 anteiso, 18:0 anteiso, 22:2 \(n\)-6, 22:4 \(n\)-3, 22:5 \(n\)-6 and 23:0). Positional isomers of unsaturated fatty acids were not specified further.

### Carbohydrates in the food groups

The concentrations of carbohydrate constituents in the food groups are given in Table 3. Starch content was highest in cereals, followed by potatoes and pastries. The content of

### Table 4. Content of total fat and major fatty acid categories (g/person per d) included in market baskets purchased in 2005 and 2010

| Food groups | Year | Total fat | SFA | MUFA | PUFA | Trans-fatty acids | \(n\)-6 Fatty acids | \(n\)-3 Fatty acids |
|-------------|------|-----------|-----|------|------|-------------------|------------------|------------------|
| Cereals     | 2005 | 6·5       | 0·8 | 1·8  | 1·9  | 0·01              | 1·66             | 0·27             |
|             | 2010 | 5·1       | 0·68| 1·4  | 1·5  | 0·01              | 1·28             | 0·18             |
| Pastries    | 2005 | 9·4       | 4·3 | 3·2  | 1·3  | 0·24              | 1·04             | 0·25             |
|             | 2010 | 10·1      | 4·5 | 3·8  | 1·35 | 0·07              | 1·14             | 0·20             |
| Meat        | 2005 | 26·4      | 10·8| 11·5 | 2·6  | 0·33              | 2·3              | 0·31             |
|             | 2010 | 24·8      | 10·5| 10·2 | 2·66 | 0·35              | 2·30             | 0·36             |
| Fish        | 2005 | 4·1       | 0·6 | 1·7  | 1·3  | 0·04              | 0·63             | 0·64             |
|             | 2010 | 5·8       | 0·82| 2·6  | 1·8  | 0·04              | 0·87             | 0·06             |
| Dairy products | 2005 | 25·6     | 16·4| 6·3  | 1·1  | 0·97              | 0·92             | 0·16             |
|             | 2010 | 21·6      | 13·7| 5·5  | 0·85 | 0·86              | 0·72             | 0·13             |
| Eggs        | 2005 | 1·7       | 0·5 | 0·7  | 0·2  | 0·01              | 0·21             | 0·02             |
|             | 2010 | 2·2       | 0·6 | 0·9  | 0·3  | 0·00              | 0·27             | 0·04             |
| Fats        | 2005 | 26·6      | 9·4 | 11·0 | 4·9  | 0·23              | 3·6              | 1·3              |
|             | 2010 | 26·5      | 9·6 | 10·6 | 5·0  | 0·30              | 3·9              | 1·1              |
| Vegetables  | 2005 | 0·6       | 0·1 | 0·1  | 0·3  | 0·00              | 0·21             | 0·06             |
|             | 2010 | 0·39      | 0·08| 0·05 | 0·17 | 0               | 0·13             | 0·04             |
| Fruit and berries | 2005 | 1·0     | 0·1 | 0·6  | 0·1  | 0               | 0·11             | 0·01             |
|             | 2010 | 2·5       | 0·2 | 1·5  | 0·2  | 0               | 0·2              | 0·02             |
| Potatoes    | 2005 | 3·0       | 1·4 | 1·2  | 0·3  | 0·01              | 0·28             | 0·01             |
|             | 2010 | 2·4       | 0·7 | 1·3  | 0·22 | 0·01              | 0·22             | 0·01             |
| Sweets, ice cream | 2005 | 2·8  | 1·7 | 1·0  | 0·2  | 0·01              | 0·16             | 0·01             |
|             | 2010 | 14·6      | 7·0 | 5·36 | 1·50 | 0·07              | 1·19             | 0·31             |

### Total (per person per d)

| Year | Total fat | SFA | MUFA | PUFA | Trans-fatty acids | \(n\)-6 Fatty acids | \(n\)-3 Fatty acids |
|------|-----------|-----|------|------|-------------------|------------------|------------------|
| 2005 | Mean      | 108 | 46·2 | 39·1 | 14·2             | 1·9              | 11·2             |
|      | Range     | 102–116 | 42·4–49·8 | 35·3–42·4 | 13·1–14·9 | 1·5–2·2 | 10·4–11·8 | 2·7–3·2 |
| 2010 | Mean      | 116 | 48·3 | 42·1 | 15·3             | 1·7              | 12·0             |
|      | Range     | 115–117 | 48·0–48·5 | 40·1–44·2 | 14·6–16·1 | 1·7–1·8 | 11·6–12·5 | 3·1–3·5 |

ND, not detected; NA, not analysed.
glucose and fructose was high in fruit and berries, while the content of sucrose was highest in sugars and sweets, pastries, and soft drinks. Maltose was mainly found in cereals. Polyols were analysed in the 2005 MB and sorbitol was detected in small amounts in fruit and berries (jam and cordials) and in sweets. Xylitol was not detected in any of the food groups. The content of dietary fibre was highest in cereals. There were generally small differences between the 2005 and 2010 MB, although sucrose content in fruit and berries was lower in 2005 than in 2010 (Table 3). In the 2005 MB, variation between the cities was generally low or moderate (CV 10–20%) for major constituents (>2 g/100 g) in the various food categories. In the 2010 MB, differences in the concentrations of fatty acid categories and carbohydrate constituents in the food groups between the standard-price and low-price baskets were generally small.

**Daily supply**

The average daily dietary supply of total fat and fatty acids and of carbohydrate constituents are given in Tables 4 and 5. Percentage contribution from food groups in the 2010 MB is shown in Figs. 1–5. The content of glycaemic carbohydrates was calculated as the sum of starch and total sugars. The term ‘glycaemic carbohydrates’ is defined as carbohydrates that are absorbed in the small intestine and includes oligosaccharides, in addition to starch and sugars\(^{(25)}\).

**Fat and fatty acids.** The average dietary supply of total fat in the 2010 MB was 116 g/person per d. The major contributors
were fats and oils (23%), meat (21%) and milk products (19%). Pastries contributed 9%, and sugar and sweets contributed 13%. The average content of SFA was 48 g/person per d. Dairy products contributed 28% SFA, meat 22% SFA and fats 20% SFA (Fig. 1). The average content of MUFA was 42 g/person per d, and the major contributors were meat (24%) and fats (25%), dairy products, and sugar and sweets, with each contributing 13% (Fig. 1). The average content of PUFA was 15 g/person per d, of which 12 g was from n-6 fatty acids and 3·3 g from n-3 fatty acids, respectively. The major contributors of n-6 fatty acids (linoleic acid) were fats (32%) and pastries (19%). Fats contributed 35% of n-3 fatty acids (as α-linolenic acid) and fish 26%, mainly as EPA and DHA. The average exposure to TFA was 1·7 g/person per d. The major contributors were dairy products (50%), followed by meat (20%) and fats (18%). Dairy products also contributed the main part of the individual TFA isomers (Fig. 2).

The average dietary supply of individual fatty acids is shown in online Supplementary Table S2. Palmitic acid (16:0) was the main SFA followed by stearic acid (18:0) and myristic acid (14:0). Oleic acid (18:1) was the main MUFA, while linoleic acid was the main PUFA, followed by.
α-linolenic acid. Long-chain n-3 fatty acids, EPA and DHA, contributed 0·18 and 0·33 g/person per d, respectively. 18:1 Δ9 was the main trans isomer.

Compared with the 2005 MB, the dietary supply of total fat was higher, mainly due to a large contribution from the sugar and sweets group, in which chocolate and ice cream are high in fat. This difference may be due to the fact that ice cream was under-represented in the 2005 MB. The content of TFA was 1·7 g/person per d, compared with 1·9 g/d in 2005. A major decrease in TFA content was observed in the pastries group, which in 2005 contributed 13 % of the total TFA content, compared with 4 % in 2010.

Carbohydrates. In the 2010 MB, the average dietary supply for both glucose and fructose was 32 g/person per d, of which fruits contributed about half, and each of the food groups cereal products, vegetables, sugar and sweets, and beverages contributed about 10 % (Table 5 and Fig. 3). The dietary supply of sucrose was 88 g/person per d, of which sugar and sweets contributed 54 %, while pastries and beverages each contributed 14–15 % (Fig. 4). Lactose content was 18 g/person per d, of which dairy products contributed on average 83 %, and sugar and sweets another 12 %. The supply of maltose was 8·1 g/person per d, cereal products contributing about 60 %, and sugar and sweets contributing an additional 22 %. The supply of starch was 149 g/person per d, of which cereal products contributed three-quarters and potatoes 13 % (Fig. 5). The supply of dietary fibre was 21 g/person per d, cereals contributing about half, vegetables and fruits contributing about one-fifth each, and potatoes 13 % (Fig. 5). The main contributors of glycaemic carbohydrates were cereals (37 %), sugar and sweets (19 %), and fruits, including jam and cordials (14 %).

Compared with the results of the 2005 MB, the average dietary supply of starch and dietary fibre was lower, while that of sucrose was higher (Table 5). In the 2005 MB, sorbitol was detected in the fruit and berries group, including fruit-based cordials and jam, and in the sugar and sweets group. Xylitol was not detected in any of the food groups.

Discussion

The present study provides the most extensive analytical investigation to date of the composition of fat and carbohydrate constituents in the Swedish diet. It gives detailed data on more than fifty individual fatty acids and major carbohydrate components including mono- and disaccharides, starch, total dietary fibre and some polyols. In Sweden, two sets of FBS data are calculated(11). In the present study, the data refer to the so-called ‘direct consumption’, which is relatively detailed and represents foods available for consumption at the retail and wholesale levels for an average person during a year. The amounts of food in the MB overestimate actual consumption, since edible losses due to waste in the retail and household sectors are not accounted for and because of some uncertainties in basic statistics. However, the data give an overall picture of the composition of the average diet, although the MB approach gives no information on food intake at the individual level. Foods vary in composition depending on variety, brand, season, etc. To increase variability, MB were purchased in two major food stores in four cities of Sweden in 2005. In 2010, two food baskets were purchased from each of four major food chains, one standard-price and one low-price basket, with complementary baskets from a fifth chain that did not cover the full list of included items.
Table 6. Major fatty acid categories according to food disappearance statistics

| Year      | SFA | MUFA | PUFA | Reference                  |
|-----------|-----|------|------|----------------------------|
| 1965      | 54  | 38   | 9.2  | Becker (43)                |
| 1975      | 49  | 37   | 14   | Bruce & Westin (42)        |
| 1980      | 47  | 37   | 15   | Becker (43)                |
| 1992      | 45  | 39   | 16   | Becker & Robertson (44)    |
| 2005 MB   | 46  | 40   | 14   | Present study              |
| 2010 MB   | 45  | 340  | 15   | Present study              |

MB, market basket.
* Percentage of total fatty acids. Values for 1965–92 were calculated from food composition data.

The estimated energy supply in the 2010 MB was about 12·5 MJ/person per d, which is in line with calculations based on the total per capita supply (excluding energy from alcoholic beverages) (11). Using this estimate, total fat was found to contribute 34 % of energy (%), SFA 14·3 %, MUFA 12·8 %, PUFA 4·6 %, n-6 fatty acids 3·6 %, n-3 fatty acids 1·0 % and TFA 0·5 % in 2010. According to the Nordic Nutrition Recommendations 2012, intake of SFA should be limited to less than 10 %, while intake of PUFA should be 5–10 %, of which intake of n-3 fatty acids should be 1 % (24). Thus, the estimated supply of SFA was higher, while that of PUFA is slightly lower than the recommended lower threshold.

Some differences between the two MB were observed. The dietary supply of total fat was higher in the 2010 MB, mainly due to a large contribution from the sugar and sweets group, in which chocolate and ice cream have high fat content. The observed difference may be due to the fact that ice cream was under-represented in the 2005 MB. The supply of TFA was 1·7 g/person per d, compared with 1·9 g/person per d in 2005. A major decrease in TFA content was observed in the pastries group, which contributed 13 % of the total TFA content in 2005, compared with 4 % in 2010. TFA content corresponds to about 0·5 %, which is well below the WHO recommendation stating that TFA should contribute with no more than 1 % (24). About 75 % of TFA are derived from ruminant sources.

Using the estimated energy supply of 12·5 MJ in the 2010 MB, monosaccharides contributed 9 %, sucrose 12 %, disaccharides 16 % and total sugars 24 %. Glycaemic carbohydrates contributed 45 %. Dietary fibre content corresponded to approximately 1·7 g/MJ. The amount of added sugars was estimated from the content of monosaccharides and sucrose in the food groups. Monosaccharides and sucrose from all food groups, except for fruit and berries, jam and cordials, and potatoes, were calculated as added. Monosaccharides and sucrose in jam and cordials were also included, after correction for naturally occurring sugars in the fruit and berries group. The calculated amount of added sugars was 113 g/person per d, corresponding to approximately 15 %. The corresponding calculations for the 2005 MB give similar estimates for energy distribution expressed in %. The estimated supply of added sugars was higher than the upper limit of 10 % according to the Nordic Nutrition Recommendations (24).

In the dietary survey of children in Sweden in 2003, the calculated contribution of added sugars was 13–14 % (25–27). In a recent dietary survey on adults (27), estimates were lower by about 10 %, as was the intake of both monosaccharides (6·4 %) and sucrose (7·7 %). The content of dietary fibre was higher (2·0 g/MJ) in the 2005 MB than that (1·7 g/MJ) in the 2010 MB, which was lower than the recommended level of at least 3 g/MJ (24). In recent Swedish dietary surveys on children and adults (25,27), fibre intake was on average 1·7–1·8 and 2·5 g/MJ, respectively.

The results from the analyses were compared with calculations based on data in the NFA food composition database (version 04.1.1). There was generally a good agreement between estimates based on the MB and NFA food composition database, with differences within 5 % for major fatty acid categories. Analytical data gave a 28 % higher estimate of monosaccharide content and a 23 % lower estimate of sucrose and a 21 % lower estimate for dietary fibre content. However, both datasets gave a similar estimate for the content of total sugars. The content of glycaemic carbohydrates calculated from the analysis was about 45 g (14 %) lower than the calculated content of ‘available carbohydrates’ in the NFA food composition database. Values for ‘available carbohydrates’ in the database were calculated from the amount of total carbohydrates calculated ‘by difference’ after subtraction of dietary fibre content. However, values for ‘total carbohydrates’ calculated by difference may also include other non-carbohydrate components such as organic acids in fruit and vegetables. Thus, the data are not directly comparable.

MB studies or total diet studies investigating the content of fatty acids for other populations are relatively scarce, and

Table 7. Analytical data on carbohydrate constituents (g/10 MJ) according to the 2005 and 2010 market basket studies and previous duplicate diet studies in Sweden

|                      | Sucrose | Glucose | Fructose | Maltose | Lactose | Sugars (total) | Starch |
|----------------------|---------|---------|----------|---------|---------|----------------|--------|
| Market basket 2010   | 70·7    | 25·6    | 25·5     | 6·5     | 14·7    | 143            | 119    |
| Market basket 2005   | 63      | 29      | 24       | 9       | 14      | 139            | 137    |
| Adults, Dalby 1975   | 50      | 16      | NR       | NR      | 17      | NR             | 113    |
| Elderly, Dalby 1979  | 51      | 18      | NR       | NR      | 25      | NR             | 113    |
| Lacto-vegetarian diets, 1984 | 19 | 38      | 42       | 9       | 17      | 126            | 112    |
| Vegan diets, 1981    | 49      | NR      | NR       | NR      | NR      | NR             | NR     |

NR, not reported.
mainly cover the period before the year 2000. A classic study has analysed the fatty acid composition of the Greenland Eskimo food in 1970s(20), showing a high proportion and intake of long-chain n-3 fatty acids. More recent studies include total diet studies of Dutch(29,30) and Finnish(31) diets, analysis of duplicate diets in the seven-country study(52), and studies evaluating dietary assessment methods(33–45) or food composition tables(36). The intake of TFA in several European countries during 1995–97 was assessed in the TRANSFAIR study using data from national dietary surveys and analytical data for TFA in foods(37). Highest intakes were found to be 2.1 E% for men (Iceland) and 1.6 E% for women (The Netherlands), while lowest intakes were found to be 0.5 E% for men (Italy) and 0.8 E% for women (Greece). Recent data showed that TFA intakes decreased markedly in North European countries and ranged from 0.5 to 0.8 E%(38–41).

A comparison of previous calculations of fat and fatty acid supply in Sweden based on FBS data(42–44) indicated that the proportion of SFA decreased from the mid-1960s until the beginning of the 1990s, with a corresponding increase in MUFA and PUFA (Table 6). Since then, available data have indicated relatively minor changes. The corresponding calculations for TFA showed that the dietary supply was about 7 g/person per d in 1984 and about 5 g/person per d (1.1 E%) in 1994–95(45). The results from the present MB study show that the dietary supply has decreased considerably since the mid-1990s. A˚kesson et al.(46) analysed the content of 18:1 trans isomers in duplicate portions collected between 1968 and 1975 from twenty adults eating a mixed diet. Intake of trans isomers contributed about 2.1% E%. The analysis of duplicate portions from lacto-vegetarians (six subjects) and vegans (six subjects) collected between 1978 and 1980 in a health resort showed that the content of 18:1 trans isomers contributed about 1.3% and 0.5% E%, respectively(47). In the present MB survey, 18:1 trans isomers contributed 0.4% E% in 2005 and 0.3% E% in 2010.

Calculations from dietary surveys on Swedish adults showed that intake of TFA was about 1 E% during the late 1990s(47). The average intake of TFA among Swedish children in 2003 was 0.9 E%(27). Since then, TFA content has decreased in several foods(48), which can explain the lower level found in the MB studies. The results also showed that the average content of TFA was at the same level as in Denmark(58), Norway(40) and Finland(41).

There are also some studies providing analytical data on the content of carbohydrates in the Swedish diet, dating from the 1970s. These include duplicate portion studies of twenty adults (25–60 years) and thirty-seven pensioners (67 years)(49,50), lacto-vegetarian diets(47) and vegan diets(47,51). These results are shown in Table 7. Due to the limited number of subjects, being residents of a small community of South Sweden, no firm conclusions could be drawn with respect to time trends.

MB studies or total diet studies from other countries or regions on carbohydrate constituents are also scarce and old. van Dokkum et al.(29) reported the content of carbohydrate constituents in the MB of male Dutch adolescents, while other studies have used the duplicate portion technique to validate food composition databases(54) or dietary assessment methods(52).

Conclusions

The present MB survey shows that the dietary supply of SFA and added sugars in Sweden is higher than the current Nordic Nutrition Recommendations(24), while the dietary supply of total PUFA and especially dietary fibre is lower. The results also indicate a need for updating of values for individual sugars in the database. The results are generally in line with recent national dietary surveys, and emphasise a focus on quality and food sources of fat and carbohydrates, replacing foods high in SFA and added sugars with foods that contribute with unsaturated fatty acids and naturally occurring dietary fibre.

Supplementary material

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S0007114515000501

Acknowledgements

The authors thank Ingalill Gadhasson and Elvy Netzel for their excellent technical support.

The present study was partly financed by grants from the Swedish Environmental Protection Agency. The funder had no role in the design and analysis of the study or in the writing of this article.

The authors’ contributions are as follows: W. B. had main responsibility for the study design and writing of the manuscript; A. E. carried out the analysis of carbohydrate constituents; M. H. and S. W. carried out the analysis of fatty acids. All authors contributed to the writing of the manuscript.

There are no conflicts of interest.

References

1. ANSES (2011) Opinion Regarding the Results of the National Surveillance Study on Dietary Exposure to Chemical Substances (Total Diet Study 2 – 2006–2010). Paris: ANSES – French Agency for Food, Environmental and Occupational Health & Safety.
2. EFSA (2011) Towards a harmonised Total Diet Study approach: a guidance document. EFSN J 9, 2450.
3. FDA (2013) Total Diet Study. http://www.fda.gov/food/foodsciencresearch/totaldietetstudy/default.htm (accessed 6 August 2014).
4. Rose M & Robinson S (2014) Total Diet Study: Dietary Exposure to Organic Environmental Contaminants. Report to the Food Standards Agency. Sand Hutton: Food and Environment Research Agency (FERA).
5. Becker W & Kumpulainen J (1991) Contents of essential and toxic mineral elements in Swedish market-basket diets in 1987. Br J Nutr 66, 151–160.
6. Johrem L, Becker W & Slorach S (1998) Intake of 17 elements by Swedish women, determined by a 24-h duplicate portion study. J Food Compos Anal 11, 32–46.
7. Darnerud PO, Atuma S, Aune M, et al. (2006) Dietary intake estimations of organohalogen contaminants (dioxins, PCB,
PBDE and chlorinated pesticides, e.g. DDT) based on Swedish market basket data. *Food Chem Toxicol* **44**, 1597–1606.
8. Becker W, Jorhem L, Sundström B, et al. (2011) Contents of mineral elements in Swedish market basket diets. *J Food Compos Anal* **24**, 279–287.
9. Tornqvist A, Glynn A, Aune M, et al. (2011) PCDD/F, PCB, PBDE, HBCD and chlorinated pesticides in a Swedish market basket from 2005 – levels and dietary intake estimations. *Chemosphere* **83**, 193–199.
10. SBA (2009) *Consumption of Foods and Their Nutrient Content up to Year 2003*. Statistics Report 2005-4. Jönköping: Swedish Board of Agriculture.
11. SBA (2009) *Consumption of Foods and Their Nutrient Content up to Year 2007*. Statistics Report 2009-5. Jönköping: Swedish Board of Agriculture.
12. Lennernäs M, Fjellström C, Becker W, et al. (1997) Influences on food choice perceived to be important by nationally-representative samples of adults in the European Union. *Eur J Clin Nutr* **51**, S8–S15.
13. NMKL (2010) *Fat in Milk*. Gravimetric Determination. Nordic Committee on Food Analysis. NMKL no. 10, 4th ed. Oslo: Norwegian Veterinary Institute.
14. NMKL (1989) *Determination of Fat by SBR in Meat and Meat Products*. Nordic Committee on Food Analysis. NMKL 131. Oslo: Norwegian Veterinary Institute.
15. Folch J, Lees M & Sloane Stanley GH (1957) A simple method for the isolation and purification of total lipides from animal tissues. *J Biol Chem* **226**, 497–509.
16. IUPAC (1979) *Gas–Liquid Chromatography of Fatty Acid Methyl Esters*, 6th ed. Part 1, 2,302.
17. AOCS (1996) *Official Method Ce-1f-96. Determination of cis- and trans-Fatty Acids in Hydrogenated and Refined Oils and Fats by Capillary GLC*. Urbana, IL: The American Oil Chemists’ Society.
18. EEC (1998) Commission Directive 98/64/EC of 3 September 1998 establishing community methods of analysis for the determination of amino acids, crude oils and fats, and ola- quindox in feedingstuffs and amending Directive 71/395/EEC. *Off J Eur Commun* **L275**, 14–28.
19. NMKL (2001) *Fat in Milk. Gravimetric Determination*. Nordic Committee on Food Analysis. NMKL no. 10, 4th ed. Oslo: Norwegian Veterinary Institute.
20. Fuchs G, Gawell BM & Lidhem B (1974) Quantitative determination of low-molecular carbohydrates in foods by gas–liquid chromatography. *Swed J Agric Res* **4**, 49–52.
21. NMKL (1997) *Starch and Glucose. Enzymatic Determination in Foods*. Nordic Committee on Food Analysis. NMKL 145, 2nd ed. Oslo: Norwegian Veterinary Institute (2006/2007. Amendment).
22. NMKL (2005) *Total Dietary Fibre*. Nordic Committee on Food Analysis. NMKL 120, 2nd ed. Oslo: Norwegian Veterinary Institute.
23. Cummings JH & Stephen AM (2007) Carbohydrate terminology and classification. *Eur J Clin Nutr* **61**, S5–S18.
24. NCM (2014) *Nordic Nutrition Recommendations 2012. Integrating Nutrition and Physical Activity*. Nord 2014:002. Copenhagen: Nordic Council of Ministers.
25. Amcoff E, Edberg A, Enghardt Barbieri H, et al. (2012) *Riksmatet – Adults 2010–11* (in Swedish). Uppsala: National Food Agency.
26. FAO/WHO (2010) *Fats and Fatty Acids in Human Nutrition*. Report of an Expert Consultation. 10–14 November 2008, *Geneva FAO Food and Nutrition Paper*. Rome: Food and Agricultural Organisation of the United Nations.
27. Enghardt Barbieri H, Pearson M & Becker W (2006) *Riksmatet – Barn 2003. Food and Nutrient Intake among Children in Sweden* (in Swedish). Uppsala: National Food Administration.
28. Bang HO, Dyerberg J & Sinclair HM (1980) The composition of the Eskimo food in north western Greenland. *Am J Clin Nutr* **33**, 2657–2661.
29. van Dokkum W, de Vos RH, Dukel F, et al. (1990) Analysis of macromonomer and fatty acids in the market basket of male adolescents in The Netherlands. *J Am Diet Assoc* **90**, 77–81.
30. Schothorst RC & Jekel AA (2000) Results of analysis of the 1994 Dutch duplicate 24-hour diet samples: fatty acids. *Food Chem* **70**, 515–521.
31. Heimonen M, Lampa A-M, Hyvönen L, et al. (1992) The fatty acid and cholesterol content of the average Finnish diet. *J Food Comp Anal* **5**, 198–208.
32. de Vries J, Jansen A, Kronhout D, et al. (1997) The fatty acid and sterol content of food composites of middle-aged men in seven countries. *J Food Compos Anal* **10**, 115–141.
33. Ritzenhalter KL, McGuire MK, Falen R, et al. (2001) Estimation of conjugated linoleic acid intake by written dietary assessment methodologies underestimates actual intake evaluated by food duplicate methodology. *J Nutr* **131**, 1548–1554.
34. Fidanza F & Perriello G (2002) Validation of the Italian food composition database of the European institute of oncology. *Eur J Clin Nutr* **56**, 1004–1010.
35. Brady LM, Lesauvage SV, Saini N, et al. (2005) Comparison of dietary fat and fatty acid intake estimated by the duplicate diet collection technique and estimated dietary records. *J Hum Nutr Diet* **16**, 395–401.
36. Broadhurst AJ, Stockley L, Wharf SG, et al. (1987) Validity of calculating fatty acid intake from mixed diets. *Hum Nutr Appl Nutr* **41**, 101–106.
37. Hulshof KFAM, van Erp-Baart MA, Anttolainen M, et al. (1999) Intake of fatty acids in Western Europe with emphasis on trans fatty acids: The TRANSFAIR study. *Eur J Clin Nutr* **53**, 143–157.
38. Pedersen AN, Fagt S & Velsing Groth M (2010) *Dietary Habits of Danes 2003–2008. Main Results* (in Danish). Copenhagen: DTU Fødevareinstituttet.
39. van Rossum CTM, Fransen HP, Verkaik-Kloosterman J, et al. (2011) Dutch National Food Consumption Survey 2007–2010. *Diet of Children and Adults Aged 7 to 69 Years. Report no. 350050006/2011*. National Institute for Public Health and the Environment. Bilthoven: RIVM.
40. Helsedirektoratet (2012) *Utviklingen i norsk kosthold. Mat- fornyningsstatistikk og Forbrukinarsiderlesker (Developments in the Norwegian Diet. Food Supply Statistics and Consumption Surveys)*. Oslo: Directorate of Health.
41. Höldkön A, Kosonen M & Tapamäen H (2013) *The National FINDEIT 2012 Survey. (In Finnish, Summmary, Figures and Tables in English)*. Helsinki: National Institute for Health and Welfare.
42. Bruce À & Westin SI (1978) The present Swedish consumption of fat and fatty acids in relation to the US Dietary Goals (in Swedish with English summary). *Vår Fôda* **30**, 259–268.
43. Becker W (1990) Fat consumption in Sweden – recent trends illustrated by food balance sheet data. *Näringsforskning* **40**, 70–73.
44. Becker W & Robertson A-K (1994) Nutrient content of the Swedish diet (in Swedish). *Vår Fôda* **46**, 374–385.
45. Becker W (1996) Intake of trans fatty acids in the Nordic countries. *Scand J Nutr/Näringsforskning* **40**, 16–18.
46. Åkesson B, Johansson BM, Svensson M, et al. (1981) Content of trans-octadecenoic acid in vegetarian and normal diets in Sweden, analyzed by the duplicate portion technique. *Am J Clin Nutr* **34**, 2517–2520.
47. Abdulla M, Aly KO, Andersson I, et al. (1984) Nutrient intake and health status of lactovegetarians: chemical analyses of
48. Mattisson I, Trattner S & Wretling S (2011) *Fat Quality 2007: Trends in Fatty Acid Composition over the Last Decade*. Uppsala: National Food Administration.

49. Borgström B & Nordén A (1975) A study of the food consumption by the duplicate portion technique in a sample of the Dalby population, Sweden. *Scand J Soc Med* 10, 9–98.

50. Borgström B & Nordén A (1979) Nutrition and old age. Chemical analyses of what old people eat and their states of health during 6 years of follow-up. *Scand J Gastroenterol* 52, 1–269.

51. Abdulla M, Andersson I, Asp NG, *et al.* (1981) Nutrient intake and health status of vegans. Chemical analyses of diets using the duplicate portion sampling technique. *Am J Clin Nutr* 34, 2464–2477.

52. Laryea MD, Schnittert B, Kersting M, *et al.* (1995) Macronutrient, copper, and zinc intakes of young German children as determined by duplicate food samples and diet records. *Ann Nutr Metab* 39, 271–278.