Seven distinct dietary patterns identified among pregnant Finnish women – associations with nutrient intake and sociodemographic factors

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Abstract

Objectives: To identify and describe dietary patterns in a cohort of pregnant women and investigate whether the dietary patterns are associated with dietary intake and sociodemographic factors.

Design: Mothers entering the Finnish Type 1 Diabetes Prediction and Prevention (DIPP) Nutrition Study in 1997–2002 were retrospectively asked to complete a food-frequency questionnaire concerning their diet during pregnancy. Principal components analysis was used to identify dietary patterns.

Setting: Finland.

Subjects: Subjects were 3730 women with a newborn infant carrying increased genetic susceptibility to type 1 diabetes mellitus.

Results: Seven factors were identified and named. Energy intake correlated positively with ‘Healthy’, ‘Fast food’, ‘Traditional bread’, ‘Traditional meat’ and ‘Coffee’ patterns and inversely with the ‘Alcohol and butter’ pattern. Intake of dietary fibre correlated positively with ‘Healthy’, ‘Traditional bread’ and ‘Low-fat foods’ patterns and inversely with the ‘Alcohol and butter’ pattern. The seven dietary patterns seemed to account for relatively large proportions of the variance in energy and nutrient intakes except for the intake of vitamin D, vitamin C, carotenoids and calcium. Maternal age and higher level of education were associated with higher scores on ‘Healthy’, ‘Low-fat foods’ and ‘Alcohol and butter’ patterns.

Conclusion: Principal components analysis produced seven dietary patterns which may be useful for further research concerning maternal diet and health outcomes among both mothers and their offspring.

Proper nutrition during pregnancy is considered important both for maternal health and foetal growth and development, and hence is addressed by dietary recommendations. An appropriate diet also helps the mother to recover from delivery and supports successful breastfeeding. The traditional way to assess the diet is to examine energy and nutrient intakes or the consumption of certain food items. Dietary pattern analysis is an approach that aims to describe the whole diet in combination. The use of dietary patterns might help to capture some of the complexity of diet that is often lost in nutrient-based analyses, and provide additional information in exploring the relationship between nutrition and health. All foods contribute to nutritional status and it is not the presence or absence of a single food but the appropriate selection of foods in suitable quantities and combinations that is important to health.

Maternal food and nutrient intake during pregnancy has been investigated, but as far as we know only two studies have used dietary pattern analysis. The first was performed among Mexican American mothers and reported seven maternal eating patterns. The second was...
a longitudinal study that found two stable dietary patterns from preconception to postpartum in a small cohort ($n = 80$) of Spanish women.

Dietary patterns identified by exploratory factor analysis are reported to account for relatively large proportions of the variance in energy and macronutrient intakes in middle-aged women and men, and to relate to many sociodemographic and lifestyle factors both in women and men. There is evidence from earlier studies that older, highly educated and non-smoking pregnant women eat more healthily than others.

The aim of the present study was to identify and describe dietary patterns in a cohort of pregnant Finnish women. We also examined whether the dietary pattern scores vary by energy and nutrient intakes or sociodemographic factors.

Subjects and methods

Subject sample
This analysis represents part of the Nutrition Study within the Finnish Type 1 Diabetes Prediction and Prevention Study (DIPP), which aims to evaluate the effects of both childhood diet and maternal nutrition during pregnancy and lactation on the development of β-cell autoimmunity and type 1 diabetes mellitus in the offspring. All families with newborn infants carrying increased HLA (human leucocyte antigen)-conferred susceptibility to type 1 diabetes (genotype HLA DQB1*02/*0302 or HLA DQB1*0302/*x; x≠ *02, *0301 or *0602) in the Oulu and Tampere University Hospital regions were invited to participate. The present analysis included mothers who gave birth between October 1997 and December 2002 ($n = 5362$). Complete nutrition information was received from 3730 mothers (70% of those invited), who formed the final study population. Sociodemographic data were collected using a structured questionnaire. Those women who did not provide complete nutritional information were less educated and had more children than those who provided nutritional information. Age and smoking during pregnancy did not differ between these two groups. The mean age of the mothers was 30 years, varying between 16 and 47 years. Selected sociodemographic factors are presented in Table 1.

Data collection and processing
Diet during pregnancy was assessed by a food-frequency questionnaire (FFQ) comprising a list of 181 food items that was validated by Erkkola et al.

The FFQ assessed the use of foods or food groups and the consumption frequency (number of times per day, week or month) as common serving sizes. The questionnaire was specifically designed to reflect Finnish food consumption habits. Mothers were asked to answer questions concerning their diet during the month preceding the maternity leave in Finland, i.e. the eighth month of pregnancy. A notice concerning the period of interest was repeated on each page of the questionnaire. Mothers received the questionnaire after delivery and it was returned and checked by a study nurse at the infant’s 3-month visit to the study centre. The food consumption data were entered into a dietary database using a software program of the National Public Health Institute, Helsinki, Finland. In-house software with the Fineli national food composition database was used to calculate daily nutrient intakes. The selected frequency category for each food item in the FFQ was converted to a daily intake. The detailed content of the FFQ and data processing have been described elsewhere.

Statistical methods
The 181 food items were aggregated into 52 separate food groups (Table 2). The grouping scheme was based on culinary use and nutrient profiles. Principal components analysis with varimax rotation was used to identify patterns among the food groups. The factor model is driven by the idea that correlated variables belong together, and they should be recognised as distinct from groups of variables with which they are not correlated. A plot of eigenvalues (i.e. the Scree test) indicated a break between the seventh and eighth factor which could be used as a separate criterion to the solution of seven factors that were retained for further analyses. After varimax rotation of the factors, food groups with absolute factor loading ≤ −0.2 or ≥0.2 were considered as significantly contributing to a pattern. Factor scores were calculated for each person in each pattern in terms of how closely they fit the pattern. Factor scores were computed by weighting

### Table 1: Characteristics of 3730 pregnant Finnish women

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at delivery (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>723</td>
<td>19</td>
</tr>
<tr>
<td>25–29</td>
<td>1277</td>
<td>34</td>
</tr>
<tr>
<td>30–34</td>
<td>1103</td>
<td>30</td>
</tr>
<tr>
<td>≥35</td>
<td>628</td>
<td>17</td>
</tr>
<tr>
<td>Basic education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No high school degree</td>
<td>1675</td>
<td>45</td>
</tr>
<tr>
<td>High school degree</td>
<td>1845</td>
<td>49</td>
</tr>
<tr>
<td>Missing data</td>
<td>211</td>
<td>6</td>
</tr>
<tr>
<td>Smoking during pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3214</td>
<td>86</td>
</tr>
<tr>
<td>Yes</td>
<td>380</td>
<td>10</td>
</tr>
<tr>
<td>Missing data</td>
<td>137</td>
<td>4</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tampere</td>
<td>2196</td>
<td>59</td>
</tr>
<tr>
<td>Oulu</td>
<td>1535</td>
<td>41</td>
</tr>
<tr>
<td>Number of earlier deliveries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1668</td>
<td>45</td>
</tr>
<tr>
<td>1</td>
<td>1170</td>
<td>31</td>
</tr>
<tr>
<td>2 or more</td>
<td>826</td>
<td>22</td>
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<tr>
<td>Missing data</td>
<td>67</td>
<td>2</td>
</tr>
</tbody>
</table>
each factor loading by the factor’s eigenvalue, multiplying these weights with the subject’s corresponding food group intake, and summing these products. Factor scores were used to rank individuals.

Pearson’s correlation coefficients were calculated between dietary patterns and energy and nutrient intakes. Multiple linear regression analysis was used to test how age, educational level, smoking during pregnancy, living area and the number of earlier deliveries explained the variance in pattern scores. All statistical analyses were performed using SPSS for Windows v. 14.0 (SPSS Inc.).

### Results

#### Dietary patterns

Seven factors were identified to describe the dietary patterns of the pregnant Finnish women (Table 3). Collectively these factors explained 29.5% of the variability within the sample. Food items with loadings of $\pm 0.2$ on a factor were considered to have a strong association with that factor. Negative loading ($\leq -0.2$) represents an inverse association between the food item and the factor. The seven factors were named according to the food item

<table>
<thead>
<tr>
<th>Food or food group</th>
<th>Food items included in group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leafy vegetables</td>
<td>Lettuce</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Red and white cabbage, cauliflower, kohlrabi, sauerkraut</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Tomato, cucumber, sweet pepper, onion, garlic, corn, avocado, sprouts</td>
</tr>
<tr>
<td>Fish</td>
<td>Fish, canned fish, smoked fish</td>
</tr>
<tr>
<td>Vegetarian dishes</td>
<td>Vegetable soup, risotto, vegetarian patty</td>
</tr>
<tr>
<td>Legumes and mushrooms</td>
<td>Beans, lentils, green peas, mushrooms</td>
</tr>
<tr>
<td>Roots</td>
<td>Carrot, vegetable mix, red beet, rutabaga</td>
</tr>
<tr>
<td>Berries</td>
<td>Strawberry, blackcurrant, blueberry, lingonberry, gloudberry, berry soup</td>
</tr>
<tr>
<td>Salad dressing</td>
<td>Vegetable oil dressing, low-fat dressing, mayonnaise</td>
</tr>
<tr>
<td>Poultry</td>
<td>Poultry</td>
</tr>
<tr>
<td>Fruits</td>
<td>Orange, apple, banana, pear, peach, grapefruit, plum, pineapple, water melon, kiwi fruit,</td>
</tr>
<tr>
<td></td>
<td>fruit salad, dried fruit</td>
</tr>
<tr>
<td>Rice and pasta</td>
<td>Rice, pasta</td>
</tr>
<tr>
<td>Egg</td>
<td>Boiled eggs, fried eggs</td>
</tr>
<tr>
<td>Sweets</td>
<td>Sweets</td>
</tr>
<tr>
<td>Fast food</td>
<td>Pizza, hamburger, deep-fried meat pasty</td>
</tr>
<tr>
<td>Snacks</td>
<td>Crisps, salted nuts, popcorn</td>
</tr>
<tr>
<td>Chocolate</td>
<td>Chocolate, chocolate sauce, hot chocolate</td>
</tr>
<tr>
<td>Fried potatoes</td>
<td>Fried potatoes, French fries, potato casserole</td>
</tr>
<tr>
<td>Soft drinks</td>
<td>Carbonated beverages</td>
</tr>
<tr>
<td>Cream</td>
<td>Cream in coffee, whipped cream, ice cream</td>
</tr>
<tr>
<td>Fruit juices</td>
<td>Orange juice, apple juice, other fruit juice</td>
</tr>
<tr>
<td>White bread</td>
<td>White bread, white crisp roll</td>
</tr>
<tr>
<td>Processed vegetables</td>
<td>Vegetable juices, ketchup, pickled vegetables</td>
</tr>
<tr>
<td>Light soft drinks</td>
<td>Low-energy carbonated beverages</td>
</tr>
<tr>
<td>Savoury</td>
<td>Carelian pastry, cream crackers, pancakes</td>
</tr>
<tr>
<td>Low-fat pastry</td>
<td>Low-fat cakes, traditional bunny</td>
</tr>
<tr>
<td>Whole-grain bread</td>
<td>Whole-grain soft bread, rye bread, crispbread</td>
</tr>
<tr>
<td>High-fat pastry</td>
<td>High-fat cakes, cream cakes, cookies</td>
</tr>
<tr>
<td>High-fat cheese</td>
<td>High-fat cheese, special cheese</td>
</tr>
<tr>
<td>Sugar and jam</td>
<td>Sugar in coffee, jam, sugar, honey</td>
</tr>
<tr>
<td>Berry juices</td>
<td>Berry juices</td>
</tr>
<tr>
<td>Meat</td>
<td>Steaks, stews</td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td>Nuts, seeds</td>
</tr>
<tr>
<td>Breakfast cereals</td>
<td>Breakfast cereals, muesli, porridge</td>
</tr>
<tr>
<td>Meat dishes</td>
<td>Meat dishes including potato, rice or pasta</td>
</tr>
<tr>
<td>Sausage</td>
<td>Sausage dishes</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Boiled potato, baked potato, mashed potato</td>
</tr>
<tr>
<td>Processed meat</td>
<td>Cold cuts, bacon, canned meat, smoked meat</td>
</tr>
<tr>
<td>Organ meat</td>
<td>Liver, blood</td>
</tr>
<tr>
<td>Spread 40–60%</td>
<td>Butter–vegetable oil 40–60%, soft margarine 40–60%</td>
</tr>
<tr>
<td>Low-fat cheese</td>
<td>Low-fat cheese, fat-modified cheese</td>
</tr>
<tr>
<td>High-fat milk</td>
<td>Whole milk, 1.9% milk</td>
</tr>
<tr>
<td>Low-fat milk</td>
<td>Skimmed milk, 1% milk</td>
</tr>
<tr>
<td>Butter</td>
<td>Butter, butter–vegetable oil 80%</td>
</tr>
<tr>
<td>Low-fat sour milk</td>
<td>Fat-free sour milk, low-fat yoghurt</td>
</tr>
<tr>
<td>High-fat sour milk</td>
<td>Sour milk, whole yoghurt</td>
</tr>
<tr>
<td>Coffee</td>
<td>Coffee</td>
</tr>
<tr>
<td>Milk in coffee</td>
<td>Milk in coffee</td>
</tr>
<tr>
<td>Tea</td>
<td>Tea, herbal teas</td>
</tr>
<tr>
<td>Beer</td>
<td>Beer, long drink</td>
</tr>
<tr>
<td>Wine, liquor</td>
<td>White wine, red wine, dessert wine, spirits</td>
</tr>
<tr>
<td>Soft margarine 80</td>
<td>Soft margarine 80%</td>
</tr>
</tbody>
</table>
Table 3  Factor loadings ≤−0.2 or ≥0.2 of different food items in the seven dietary factors identified using principal components analysis with varimax rotation

<table>
<thead>
<tr>
<th>Food item</th>
<th>Healthy</th>
<th>Fast foods</th>
<th>Traditional bread</th>
<th>Traditional meat</th>
<th>Low-fat foods</th>
<th>Coffee</th>
<th>Alcohol and butter</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of variability</td>
<td>7.6</td>
<td>6.1</td>
<td>3.9</td>
<td>3.2</td>
<td>3.1</td>
<td>2.9</td>
<td>2.7</td>
</tr>
<tr>
<td>Leafy vegetables</td>
<td>0.577</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage</td>
<td>0.537</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.523</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fish</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian dishes</td>
<td>0.461</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Legumes and mushrooms</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Roots</td>
<td>0.421</td>
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<tr>
<td>Berries</td>
<td>0.408</td>
<td>0.204</td>
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</tr>
<tr>
<td>Salad dressing</td>
<td>0.398</td>
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<td></td>
<td></td>
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<tr>
<td>Poultry</td>
<td>0.367</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fruits</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>−0.276</td>
</tr>
<tr>
<td>Rice and pasta</td>
<td>0.301</td>
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<td></td>
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</tr>
<tr>
<td>Egg</td>
<td>0.300</td>
<td>0.212</td>
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<tr>
<td>Sweets</td>
<td>0.595</td>
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<tr>
<td>Fast food</td>
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<tr>
<td>Snacks</td>
<td>0.537</td>
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<td></td>
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<tr>
<td>Chocolate</td>
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<tr>
<td>Soft drinks</td>
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<tr>
<td>Cream</td>
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<tr>
<td>Fruit juices</td>
<td>0.346</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>−0.214</td>
</tr>
<tr>
<td>White bread</td>
<td>0.330</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed vegetables</td>
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<td>0.321</td>
<td>0.226</td>
<td></td>
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<tr>
<td>Light soft drinks</td>
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</tr>
<tr>
<td>Savoury</td>
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<td>0.214</td>
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<tr>
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<td>0.246</td>
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<td>0.502</td>
<td>0.285</td>
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<tr>
<td>High-fat pastry</td>
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<td>0.451</td>
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</tr>
<tr>
<td>High-fat cheese</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sugar and jam</td>
<td>0.358</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Berry juices</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
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<td></td>
<td>0.553</td>
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</tr>
<tr>
<td>Nuts and seeds</td>
<td>0.320</td>
<td>0.207</td>
<td>−0.539</td>
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<td></td>
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<tr>
<td>Breakfast cereals</td>
<td>0.389</td>
<td>0.298</td>
<td>−0.470</td>
<td>−0.239</td>
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</tr>
<tr>
<td>Meat dishes</td>
<td>0.257</td>
<td>0.205</td>
<td>0.442</td>
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</tr>
<tr>
<td>Sausage</td>
<td>0.222</td>
<td>0.405</td>
<td>0.202</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Potatoes</td>
<td>−0.252</td>
<td>0.310</td>
<td>0.365</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processed meat</td>
<td>0.225</td>
<td>0.225</td>
<td>0.336</td>
<td>0.321</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organ meat</td>
<td>0.280</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Spread 40–60%</td>
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<td></td>
<td></td>
<td></td>
<td>0.577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-fat cheese</td>
<td>0.283</td>
<td>0.485</td>
<td>−0.461</td>
<td>0.281</td>
<td>−0.203</td>
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<tr>
<td>High-fat milk</td>
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<td></td>
<td>0.450</td>
<td>−0.354</td>
<td>0.327</td>
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<td>Low-fat milk</td>
<td>0.256</td>
<td>−0.354</td>
<td>0.282</td>
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<tr>
<td>Butter</td>
<td>0.256</td>
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<td></td>
<td>−0.250</td>
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<tr>
<td>Low-fat sour milk</td>
<td>0.280</td>
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<tr>
<td>High-fat sour milk</td>
<td>0.204</td>
<td></td>
<td></td>
<td></td>
<td>−0.215</td>
<td>−0.371</td>
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</tr>
<tr>
<td>Coffee</td>
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<td>0.803</td>
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<tr>
<td>Milk in coffee</td>
<td></td>
<td>0.639</td>
<td></td>
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</tr>
<tr>
<td>Tea</td>
<td>0.387</td>
<td></td>
<td>−0.463</td>
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</tr>
<tr>
<td>Beer</td>
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<td></td>
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<td></td>
<td>0.483</td>
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<tr>
<td>Wine, liquor</td>
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<td>0.486</td>
<td></td>
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<tr>
<td>Soft margarine 80</td>
<td></td>
<td>0.307</td>
<td>−0.215</td>
<td>−0.371</td>
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<td></td>
</tr>
</tbody>
</table>

Dietary patterns during pregnancy

Table 3  shows the factor loadings for different food items in the seven dietary factors identified using principal components analysis with varimax rotation. The factor loadings range from a minimum of −0.2 to a maximum of 0.8. Factors were named based on their loadings as ‘Healthy’, ‘Fast foods’, ‘Traditional bread’, ‘Traditional meat’, ‘Low-fat foods’, ‘Coffee’ and ‘Alcohol and butter’ (Table 3).

Dietary intake and sociodemographic factors

Pattern scores were differently associated with energy and nutrient intakes (Table 4). Energy intake correlated positively with ‘Healthy’, ‘Fast food’, ‘Traditional bread’ and ‘Traditional meat’ patterns and inversely with the ‘Alcohol and butter’ pattern. Intake of dietary fibre correlated positively with ‘Healthy’, ‘Traditional bread’ and ‘Low-fat foods’ patterns and inversely with the ‘Alcohol and butter’ pattern. The seven dietary patterns seemed to account for rather large proportions (over 50%) of the variance in energy and nutrient intakes except for the intake of vitamin D, vitamin C, carotenoids and calcium (Table 4).

Dietary pattern scores were differently associated with age, educational level, smoking during pregnancy, living
area and the number of earlier deliveries (Table 5). Positive associations were observed for age and the ‘Healthy’ and ‘Alcohol and butter’ patterns, while the ‘Fast foods’ and ‘Traditional meat’ patterns showed inverse associations. Positive associations were seen between educational level and the ‘Healthy’, ‘Low-fat foods’ and ‘Alcohol and butter’ patterns. Smoking during pregnancy was associated with ‘Fast foods’, ‘Traditional meat’ and with the ‘Coffee’ pattern, in particular. The number of earlier deliveries was positively associated with ‘Traditional bread’, ‘Traditional meat’ and ‘Coffee’ patterns, while inverse associations were observed for ‘Fast foods’ and ‘Low-fat foods’ patterns.

**Discussion**

We have identified and described seven dietary patterns among pregnant Finnish women. The patterns were differently related to energy and nutrient intakes and the sociodemographic factors of the women. The extensive DIPP birth cohort with a high participation rate provided an excellent opportunity for examining the dietary patterns of pregnant Finnish women. The possible effects of the knowledge that the child carried increased HLA-conferred susceptibility to type 1 diabetes mellitus on maternal dietary habits should be considered. We collected information retrospectively concerning maternal diet during the eighth month of pregnancy, although diet during the early stages of pregnancy is perceived to be more important for foetal growth and development. However, earlier findings regarding maternal diet during pregnancy suggest that dietary patterns do not change significantly from preconception to 6 months postpartum. The FFQ used in this study was developed for the Nutrition Study within the DIPP. To effectively study the putative effects of maternal diet during pregnancy on the development of type 1 diabetes in the offspring, we needed a dietary instrument that could be administered after delivery when the genetic disease susceptibility of the offspring had already been determined. In the validation study by Erkkola et al., the correlation coefficients between the second questionnaire, completed 1 month after delivery, and the food records were similar to those obtained between the first questionnaire, completed during the period of interest (eighth month of pregnancy), and the food records.

The influence of current diet is an important possible source of bias for the assessment of remote diet, and the diet during past pregnancy is recalled with perhaps slightly lower accuracy than adult diet generally. The time gap between assessment and the period of interest was 3–7 years whereas it was only a few months in our study. Some recent investigations have reported reasonable validity for questionnaires concerning adolescent diet recalled by adults many years later.

Dietary pattern analysis is used increasingly in nutritional research but it still has weaknesses. It is well known that factor analysis requires decisions to be made at several steps, starting with aggregation of dietary variables, the number of factors to be retained and

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Healthy</th>
<th>Fast foods</th>
<th>Traditional bread</th>
<th>Traditional meat</th>
<th>Low-fat foods</th>
<th>Coffee</th>
<th>Alcohol and butter</th>
<th>Proportion of variance explained†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>0.40***</td>
<td>0.52***</td>
<td>0.59***</td>
<td>0.24***</td>
<td>0.01</td>
<td>0.09***</td>
<td>–0.12***</td>
<td>86.5</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>0.50***</td>
<td>0.35***</td>
<td>0.46***</td>
<td>0.27***</td>
<td>0.19***</td>
<td>0.11***</td>
<td>–0.15***</td>
<td>71.5</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>0.38***</td>
<td>0.49***</td>
<td>0.59***</td>
<td>0.12***</td>
<td>0.06***</td>
<td>0.07***</td>
<td>–0.15***</td>
<td>77.3</td>
</tr>
<tr>
<td>Sucrose (g)</td>
<td>0.16***</td>
<td>0.62***</td>
<td>0.47***</td>
<td>0.06***</td>
<td>–0.08***</td>
<td>–0.03</td>
<td>0.001</td>
<td>64.4</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>0.62***</td>
<td>0.002</td>
<td>0.49***</td>
<td>0.01</td>
<td>0.20***</td>
<td>0.01</td>
<td>–0.19***</td>
<td>69.2</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>0.31***</td>
<td>0.53***</td>
<td>0.53***</td>
<td>0.34***</td>
<td>–0.12***</td>
<td>0.10**</td>
<td>–0.05**</td>
<td>79.3</td>
</tr>
<tr>
<td>Saturated fatty acids (g)</td>
<td>0.22***</td>
<td>0.51***</td>
<td>0.57***</td>
<td>0.26***</td>
<td>–0.18***</td>
<td>0.10**</td>
<td>–0.05**</td>
<td>74.6</td>
</tr>
<tr>
<td>3–fatty acids (g)</td>
<td>0.38***</td>
<td>0.39***</td>
<td>0.30***</td>
<td>0.34***</td>
<td>–0.08***</td>
<td>0.05**</td>
<td>–0.10***</td>
<td>52.0</td>
</tr>
<tr>
<td>Vitamin D (μg)</td>
<td>0.50***</td>
<td>0.13***</td>
<td>0.19***</td>
<td>0.19***</td>
<td>0.11***</td>
<td>0.07**</td>
<td>–0.02</td>
<td>35.3</td>
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<tr>
<td>Vitamin E (mg)</td>
<td>0.61***</td>
<td>0.40***</td>
<td>0.42***</td>
<td>0.18***</td>
<td>0.04</td>
<td>0.05**</td>
<td>–0.08***</td>
<td>74.6</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>0.47***</td>
<td>0.30***</td>
<td>0.09***</td>
<td>0.05**</td>
<td>–0.04</td>
<td>–0.05**</td>
<td>–0.23***</td>
<td>38.2</td>
</tr>
<tr>
<td>Carotenoids (μg)</td>
<td>0.65***</td>
<td>0.03</td>
<td>0.06***</td>
<td>0.10***</td>
<td>0.15***</td>
<td>0.01</td>
<td>–0.09**</td>
<td>46.9</td>
</tr>
<tr>
<td>Polate (mg)</td>
<td>0.67***</td>
<td>0.21***</td>
<td>0.44***</td>
<td>0.18***</td>
<td>0.09***</td>
<td>0.07**</td>
<td>–0.19***</td>
<td>79.1</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.55***</td>
<td>0.21***</td>
<td>0.54***</td>
<td>0.21***</td>
<td>0.13***</td>
<td>0.08**</td>
<td>–0.13***</td>
<td>71.6</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>0.55***</td>
<td>0.26***</td>
<td>0.50***</td>
<td>0.13***</td>
<td>0.15***</td>
<td>0.21***</td>
<td>–0.20***</td>
<td>74.4</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>0.50***</td>
<td>0.21***</td>
<td>0.54***</td>
<td>0.26***</td>
<td>0.13***</td>
<td>0.12**</td>
<td>–0.20***</td>
<td>73.3</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>0.31***</td>
<td>0.24***</td>
<td>0.40***</td>
<td>0.08***</td>
<td>0.13***</td>
<td>0.11**</td>
<td>–0.23***</td>
<td>39.9</td>
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<tr>
<td>Nitrate (mg)</td>
<td>0.80***</td>
<td>–0.01</td>
<td>0.94***</td>
<td>0.13***</td>
<td>0.08***</td>
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<td>67.0</td>
</tr>
<tr>
<td>Nitrite (mg)</td>
<td>0.24***</td>
<td>0.28***</td>
<td>0.34***</td>
<td>0.51***</td>
<td>0.18***</td>
<td>0.18**</td>
<td>–0.05**</td>
<td>55.5</td>
</tr>
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</table>

**P < 0.01, ***P < 0.001; the strongest associations (≥0.40 and ≤–0.40) are shown in bold.† The sum of squared correlations between absolute nutrient intake and pattern scores.

Table 4 Pearson correlation coefficients between dietary pattern score and energy and energy-adjusted nutrient intakes, and proportion of explained variance in energy and nutrient intakes in pregnant Finnish women (n = 3730)
Table 5 Selected sociodemographic factors explaining the variance in dietary pattern scores among pregnant women; regression parameters (95% confidence interval) of multiple linear regression analysis

<table>
<thead>
<tr>
<th>Sociodemographic factor</th>
<th>Model 1 Healthy</th>
<th>Model 2 Fast foods</th>
<th>Model 3 Traditional bread</th>
<th>Model 4 Traditional meat</th>
<th>Model 5 Low-fat foods</th>
<th>Model 6 Coffee</th>
<th>Model 7 Alcohol and butter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>25-29 years vs. &lt;25 years</td>
<td>0.16* (0.06, 0.25)</td>
<td>-0.08 (0.18, 0.01)</td>
<td>0.07 (0.03, 0.16)</td>
<td>-0.15* (0.25, -0.06)</td>
<td>0.21* (0.12, 0.31)</td>
<td>0.05 (0.05, 0.14)</td>
<td>0.16* (0.06, 0.25)</td>
</tr>
<tr>
<td>30-34 years vs. &lt;25 years</td>
<td>0.37* (0.27, 0.47)</td>
<td>-0.18* (0.28, -0.08)</td>
<td>0.13* (0.03, 0.24)</td>
<td>-0.23* (0.33, -0.13)</td>
<td>0.24* (0.14, 0.35)</td>
<td>0.17* (0.07, 0.27)</td>
<td>0.37* (0.26, 0.47)</td>
</tr>
<tr>
<td>35 years vs. 25 years</td>
<td>0.15* (0.06, 0.22)</td>
<td>-0.21* (0.31, 0.11)</td>
<td>0.17* (0.04, 0.29)</td>
<td>-0.24* (0.36, -0.11)</td>
<td>0.14* (0.02, 0.26)</td>
<td>0.59* (0.47, 0.71)</td>
<td></td>
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<tr>
<td>Basic education</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>High school graduates vs. no high school degree</td>
<td>0.19* (0.12, 0.26)</td>
<td>-0.09* (0.16, -0.02)</td>
<td>-0.01 (0.08, 0.06)</td>
<td>-0.13* (0.20, -0.06)</td>
<td>0.17* (0.10, 0.24)</td>
<td>-0.21* (0.28, -0.14)</td>
<td>0.20* (0.13, 0.27)</td>
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<tr>
<td>Smoking during pregnancy</td>
<td></td>
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<tr>
<td>Smokers vs. non-smokers</td>
<td>-0.27* (-0.38, -0.16)</td>
<td>0.28* (0.18, 0.39)</td>
<td>-0.18* (-0.30, -0.07)</td>
<td>0.19* (0.08, 0.30)</td>
<td>-0.19* (-0.30, -0.08)</td>
<td>0.58* (0.47, 0.69)</td>
<td>-0.05 (-0.16, 0.06)</td>
</tr>
<tr>
<td>Area</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oulu vs. Tampere</td>
<td>-0.19* (-0.26, -0.13)</td>
<td>-0.22* (-0.28, -0.15)</td>
<td>0.21* (0.14, 0.28)</td>
<td>0.06 (-0.01, 0.13)</td>
<td>0.14* (0.07, 0.21)</td>
<td>0.24* (0.17, 0.30)</td>
<td>-0.14* (-0.20, -0.07)</td>
</tr>
<tr>
<td>Number of earlier deliveries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One vs. none</td>
<td>-0.12* (-0.19, -0.04)</td>
<td>-0.05 (-0.13, 0.02)</td>
<td>0.06 (-0.01, 0.14)</td>
<td>0.38* (0.30, 0.46)</td>
<td>-0.09* (-0.17, -0.01)</td>
<td>0.18* (0.10, 0.26)</td>
<td>0.20* (0.12, 0.27)</td>
</tr>
<tr>
<td>Two or more vs. none</td>
<td>-0.10* (-0.19, -0.03)</td>
<td>-0.20* (-0.38, -0.21)</td>
<td>0.17* (0.07, 0.26)</td>
<td>0.45* (0.35, 0.54)</td>
<td>-0.14* (-0.23, -0.05)</td>
<td>0.35* (0.25, 0.44)</td>
<td>0.14* (0.05, 0.23)</td>
</tr>
</tbody>
</table>

* Significant (P < 0.05).
+ Pattern score as a dependent variable and the sociodemographic variables as independent variables.
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Conflict of interest declaration: None.

Authorship responsibilities: S.M.V. designed the Nutrition Study in DIPP and is responsible for the study. M.K. participated in the protocol development. S.M.V., T.A., U.U., R.V. and M.-L.O. were responsible for the present study concept and design. Statistical analysis was designed by M.V., T.A., S.M., M.G.K. and S.M.V., and performed by T.A. C.K.-K. was responsible for coordination of the field study and the data acquisition. U.U., C.K.-K., T.A. and S.M.V. were responsible for data processing and its supervision. The first draft of the manuscript was written by T.A. All authors contributed to the interpretation of the results and revising the manuscript.

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References