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Some similarities in dietary clusters of pre-school children and their mothers

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The diet of pre-school children is determined by the parents and carers. The aim of the present study was to describe dietary clusters of pre-school children and their mothers in Finland, and analyse the similarity of dietary clusters within child–mother pairs. The present study comprised the mothers (*n* 4862) whose child was recruited in the Type 1 Diabetes Prediction and Prevention Nutrition Study and the children belonging to selected, cross-sectional age groups of 1 year (*n* 719), 3 years (*n* 708) and 6 years (*n* 841). The dietary data were collected from children by 3-d food records and from mothers by a FFQ validated for pregnant women. The food consumption data were analysed for patterns by hierarchical cluster analysis. Three main dietary clusters were identified in children: 'healthy' and 'traditional' in all three age groups, and 'ready-to-eat baby foods' in 1-year-olds and 'fast foods, sweet' in the older children. Six main clusters were identified among the mothers who completed a FFQ for their diet during pregnancy. Some familial dependence between dietary clusters of mother–child pairs was observed in 6-year-old children but not in younger children. Younger age and lower educational level of the mother were associated with the cluster 'fast food, sweet' only at the age of 3 years. The diets of pre-school children vary by age and only a slight similarity within dietary clusters of mother–child pairs was observed.

Children: Mothers: Dietary cluster: Food consumption: Social background

Food preferences, likes and dislikes for food items, are developed in early childhood[1]. Parents and carers determine the food behaviour[1,2] of infants and toddlers by the availability of food. Maternal attitudes and health behaviour may influence children's food patterns but the implications for the child's diet may still differ from the mother's own diet[1–3]. Previous evidence suggests similarity of food habits in a family, and especially between diets of mothers and their children[3–8]. Traditional and health-conscious food choices established in childhood were observed to remain even in adulthood[9].

Complementary feeding of the child has started with infant formulas at the average age of 2 months in Finland[10,11]. Mashed vegetables, fruits and other solids follow after the age of 4–5 months[7,11–14]. Beside home-made food, manufactured baby foods[15], convenience foods[16] and other manufactured food products[17] are part of the childhood diet. Convenience-related quality of food is determined[17] to be associated with reducing the time or other input required in food shopping, preparation or cooking the meal. The nutritional composition of manufactured food products has been discussed due to their dried, isolated or condensed ingredients[15].

Child health-care clinics give advice about feeding practices to the mothers of almost all infants in Finland[10,18]. Nutrition counselling aims at promoting breast-feeding and encourages a balanced diet. Healthy food choices such as consumption of skimmed milk, whole-grain bread, and fruits and vegetables are emphasised in child health-care clinics in contrast to undesirable food behaviour, for example the consumption of high-energy snacks[2,6,19–22]. The consumption of sugar-sweetened beverages has increased in the past decade and is under consideration due to replacing more nutritious beverages[19,23]. The consumption of high-sugar food products has been reported to be associated with mothers and their children at least in infants[8], in 2-year-olds[2] and in 5-year-old daughters[5].

Cluster analysis has been used in three dietary surveys of infants or toddlers, which resulted in six[24] and seven clusters[25] or analysed beverages only[26]. Dietary patterns have been analysed more frequently by either principal component analysis[7,27–29] or factor analysis[29,30] in early childhood. The present study has the benefit of having dietary data for the child–mother pairs, which enables to study the similarity of dietary clusters within these dyads. The aim of the present

Abbreviations: DIPP, Diabetes Prediction and Prevention; FR, food records.

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study is to define the dietary clusters in the mothers and in three age groups of children in the Diabetes Prediction and Prevention (DIPP) Nutrition Study. The present study also elucidates similarities of dietary clusters within the mother–child dyads. The associations of social background factors with the clusters predicting selections of convenient foods (including ready-to-eat baby foods and fast foods) within the children were determined.

Subjects and methods

In the DIPP Study[31], newborn infants from the areas of three university hospitals in Finland were screened for HLA-DQB1 conferred susceptibility to the type 1 diabetes using cord blood samples. Infants carrying increased genetic susceptibility (HLA-DQB1*02/0302 heterozygous and DQB1*0302/x-positive subjects; x stands for homozygosity or a neutral allele) belong to cohorts being monitored for diabetes-associated auto-antibodies at 3–12-month intervals. The procedures of the study were approved by the local Ethics Committees. The mother or other representative of the family signed informed written consents.

Children and their mothers with dietary data

The DIPP Nutrition Study falls within the framework of the DIPP Study[32] and was carried out in two university hospitals (Oulu and Tampere). The present study comprises the at-risk children (*n* 2268) belonging to time-restricted, cross-sectional age groups on annual visits in 2003–2004. The food consumption was collected by 3-d food records (FR) about the first (*n* 719), third (*n* 708) or sixth (*n* 841) birthday. The FR covered both weekdays and weekend and separate forms were provided for the day care. The parents and day carers were instructed to record all the foods and drinks by estimated portions as volume or pieces. The FR was checked by a trained nurse in the study centre at annual visit. The FR were entered into a dietary database using standard volume-to-weight conversions by in-house software. Food consumption was aggregated to average daily food use (g/d) by the food classification of the food composition database[33]. Children's sex and day care (home/outside home) during recording days were entered as background factors.

The mothers participating in the DIPP Nutrition Study (*n* 4939) gave postnatal estimation of their diet during the 8th month of pregnancy[34]. The dietary data of the mothers were enquired by a 181-item FFQ, which was specifically developed and validated for the present study design[34]. Detailed information of the procedures of the FFQ and social background of the mothers has been described earlier[35]. If frequency data were inconsistent or there were ten or more food items with missing frequency data, the questionnaire was rejected (1·6 %) from the analyses. Other missing frequencies were imputed as zero. Daily energy intake and the consumption (g/d) of food items were calculated by food classification described in the earlier report[35]. The cluster analysis was carried out in all the mothers of the DIPP Nutrition Study. The effect of omitted frequencies of the FFQ was studied by sensitivity analysis of dietary clusters, and no association between omitting frequencies and clusters was observed.

The social factors of the mother and the family were enquired and entered into the study data covering age, basic and professional education, and number of siblings. The matching pairs of a child and the mother were picked to study the familial association of dietary clusters within the dyads (Fig. 1). Some mothers were included twice (*n* 134) in the pair analyses of the present study because they had twins (*n* 42) or their children were represented in two (or three) age groups.

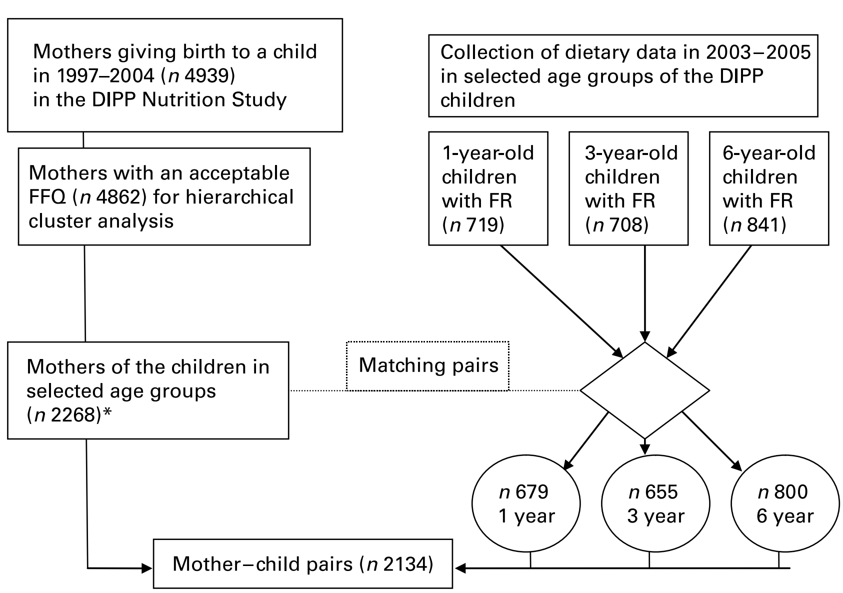

Fig. 1. Flow diagram of mothers and children used for the comparison of dietary clusters in the mother–child pairs of the Diabetes Prediction and Prevention (DIPP) Nutrition Study. * Some mothers had twins or children in two age groups. FR, food record.

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Table 1. Spearman's correlation coefficients for food groups with three dietary clusters in 1-, 3- and 6-year-old children in the Diabetes Prediction and Prevention Nutrition Study

	Clusters at 1 year of age (*n* 719)			Clusters at 3 years of age (*n* 708)			Clusters at 6 years of age (*n* 841)		
Foods	Healthy	Traditional	Ready-to-eat baby food	Healthy	Traditional	Fast food, sweets	Healthy, low-fat	Traditional	Fast food, sweets
Baby/infant formulas	−0·12	−0·13	0·23*						
Baby fruit-berry purée		−0·16	0·14		0·11	−0·11			
Baby meat dishes		−0·30*	0·34*						
Baby milk porridge		−0·23*	0·22*						
Porridge		0·21*	−0·21*	0·24*		−0·23*			−0·19
Bakery savoury				−0·10		0·16			0·16
Bakery sweet		0·20*	−0·18						
Bread, white wheat		0·16	−0·16	−0·19		0·21*	−0·14		0·14
Bread, whole cereal	0·15	0·12	−0·24*	0·15			0·24*		−0·18
Berry dishes		0·32*	−0·27*	0·22*		−0·19	0·12		−0·14
Fruits			−0·16				0·10		−0·11
Meat dishes and products		0·32*	−0·30*						−0·11
Meat, poultry dishes		0·26*	−0·29*		0·28*	−0·27*		−0·18	0·12
Sausage dishes, cold cuts		0·23*	−0·19		−0·13	0·12			
Fish dishes			−0·15	0·26*	−0·17		0·11		
Milk desserts	0·12		−0·19	−0·21*		0·19			
Milks, skimmed, low-fat	0·36*		−0·20*	0·13	−0·21*		0·35*	−0·37*	
Milks, high-fat	−0·17	0·25*			0·23*	−0·12	−0·27*	0·42*	−0·20*
Yoghurt	0·11		−0·18						
Cheeses	0·38*		−0·24*						
Potatoes		0·38*	−0·36*		−0·12			0·15	−0·17
Potatoes, fried or creamy				−0·15		0·14	−0·16	−0·12	0·32*
Sweets, chocolate and sugar		0·16	−0·16	−0·13		0·16			0·14
Nuts, dried fruit, chips				0·23		−0·15			0·22*
Sweetened beverages					−0·12	0·17	−0·21*		0·34*
Waters								−0·12	0·17
Dairy spread		0·10	−0·11	−0·15	0·36*	−0·16	−0·22*	0·19	
Fat spread, margarine		0·30*	−0·25*	0·15	−0·39*	0·18	0·25*	−0·14	−0·12
Vegetables, cooked	0·29*		−0·28*	0·22*		−0·20*	0·16	−0·12	
Vegetables, fresh	0·18	0·13	−0·27*				0·13		

*Coefficients ≤ − 0·20 or ≥0·20.

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Statistical methods

Data handling procedures

Forty-nine and fifty-two selected food groups were used to form the clusters of children and mothers, respectively. Foods that were consumed by less than 10 % of the individuals in each age group were omitted from the analysis. Such variables play little role in the description of typical behaviour, but often have undesirable effects on the group structure in terms of very small clusters of outliers. Items with a very skew distribution were coded as binary 0–1 variables, indicating whether the item was consumed at all or not. Continuous variables were winsorised at the 95th quantile (to avoid distortion by outliers), and then standardised to zero mean and unit variance before the analysis.

Hierarchical cluster analysis

After pre-processing of the data, the individuals were grouped by Ward's minimum variance method[36] implemented in SAS/PROC CLUSTER (SAS Institute, Cary, NC, USA). Boys and girls were not separated in the analysis. Different numbers of clusters were considered, and the one with the most realistic grouping was selected for reporting. Spearman's rank correlations between cluster indicator variables and the food items were estimated in order to describe cluster characteristics relative to the other groups. The rank correlation was selected because it measures here the general tendency of values to be greater (or smaller) in one group than in the others, but omits the scale of using only the rankings. Summary statistics (*n*, mean, interquartile range) were used to quantify absolute differences between the groups of children and mothers.

Analysis of associations

The associations between the background characteristics, mother's and children's dietary clusters were assessed by frequency tables and by χ^2-tests for the null hypothesis of independence of rows (the mother's cluster) and columns (the child's cluster). Statistical significance was taken as less than 5 % (two-sided). The associations between cluster membership and background variables (sex, day care, maternal age, number of siblings, basic and professional education of the mother) were investigated by logistic regression models using one and multiple explanatory variables. Obsolete and overlapping effects and second-order interactions were eliminated from the multiple logistic regression model using model selection procedures. Chosen models were not sensitive to the choice of selection procedure.

Results

Hierarchical cluster analysis resulted in three main dietary clusters in the age groups of 1, 3 or 6 years (Table 1). The 'healthy' or 'healthy, low-fat' dietary cluster was detected for each age group with high correlations in skimmed milk, whole-grain bread and vegetables. The 'traditional' cluster with a relatively high intake of dairy spread and high-fat milk was also determined for all ages. The Spearman correlation coefficients between clusters and food consumption varied, however, by age. The cluster 'fast food, sweet' had the highest positive coefficients with the intakes of sugar-sweetened beverages, fried potatoes, chips, nuts and dried fruit in 3- and 6-year-old children. In infants, the cluster 'ready-to-eat, baby foods' had high positive coefficients with intakes of infant formulas and manufactured baby foods and negative coefficient with intakes of potatoes, vegetables, bread and spread.

The differences in food consumption profiles were remarkable for the clusters of 6-year-old children, e.g. consumption of milks, soft drinks, potato or berry dishes, but slightly smaller among younger children (Tables 2–4). Similarly, for some food groups, the consumer proportion was less than 25 % as shown by the lower quartile value of 0. Even 6-year-old children consumed few food items in 3 d and the lower quartile

Table 2. Consumption statistics of main food groups (g/d measured by 3-d food records) in the dietary clusters of 1-year-old children
(Mean values and interquartile ranges)

	Healthy (*n* 147)		Traditional (*n* 258)		Ready-to-eat baby foods (*n* 314)	
Food group	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range
Baby fruit purée	72	33–105	60	7–97	84	33–125
Baby meat dishes	105	33–165	78	0–133	159	72–225
Baby milk porridge	96	0–189	64	0–83	146	0–244
Milk infant formula	130	0–213	149	0–274	254	0–447
Porridge	211	74–322	252	130–373	174	0–277
Bread, whole cereal	12	2–18	10	1–14	7	0–7
Berry dishes	12	0–10	38	0–71	6	0–1
Meat dishes	34	0–50	68	10–98	30	0–34
Milks, skimmed, low-fat	159	0–300	39	0–0	20	0–0
Milks, high-fat	59	0–67	204	0–352	115	0–147
Yoghurt	64	10–100	63	0–100	44	0–67
Potato	48	0–75	85	25–133	26	0–42
Dairy spread	1	0–0	1	0–0	0	0–0
Fat spread, margarine	1	0–1	2	0–3	1	0–0
Vegetables, cooked	44	0–50	6	0–7	2	0–0
Vegetables, fresh	10	0–12	7	0–10	3	0–2

Table 3. Consumption statistics of main food groups (g/d measured by 3-d food records) in the dietary clusters of 3-year-old children
(Mean values and interquartile ranges)

	Healthy (*n* 182)		Traditional (*n* 139)		Fast food, sweets (*n* 387)	
Food group	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range
Bread, whole cereal	39	22–53	30	14–46	31	16–43
Porridge	161	72–229	131	25–197	97	0–143
Berries	7	0–0	3	0–0	4	0–0
Berry dishes	71	3–125	47	0–76	33	0–50
Fruit, fresh	52	8–82	57	5–86	48	2–70
Meat dishes	17	0–22	31	0–56	9	0–13
Meat, poultry	102	50–143	104	50–140	104	46–148
Fish dishes	36	0–67	8	0–10	13	0–21
Milks, skimmed, low-fat	197	0–333	61	0–75	134	0–217
Milks, high-fat	198	0–347	313	150–450	185	30–300
Potato	58	20–80	42	0–60	58	20–80
Drinks, berry-based	103	10–160	86	0–117	122	33–183
Sweetened beverages	15	0–25	14	0–0	36	0–50
Nuts, dried fruit, chips	6	0–10	2	0–0	2	0–1
Sweets, sugar	8	2–11	10	2–14	14	3–20
Dairy spread	1	0–1	6	0–9	2	0–2
Fat spread, margarine	8	3–12	2	0–4	8	3–12
Vegetables, cooked	46	0–53	18	0–20	13	0–13
Vegetables, fresh	34	5–50	25	2–40	29	4–43

was 0 for many food groups (Table 4). The consumption of sweetened beverages was 3-fold for 6-year-old members of the cluster 'fast food, sweets' compared with the members of the cluster 'modern, healthy'. Even the lower quartile consumed sweets daily in all clusters of 3- and 6-year-old children. For 3-year-old children, the mean consumption of potatoes, meat dishes and bread was on the same level by all the clusters but differences existed in the consumption of porridge, cooked vegetables and milk (Table 3).

In the baby cluster 'ready-to-eat baby foods', the consumption of the lower quartile was 0 for most of the food groups except manufactured baby food products (Table 2). The consumption profile of fruit-based baby foods was as common as in all the three clusters. Instead, manufactured baby foods containing meat or cereals were common for the infants in the cluster 'ready-to-eat baby foods'. Otherwise, skimmed or low-fat milks and cooked vegetables were common in the cluster 'healthy', while high-fat milk, home-made meat dishes and porridge were common in the cluster 'traditional' among the infants.

The hierarchical cluster analysis of all the mothers enrolled in the DIPP Nutrition Study and giving dietary data (*n* 4862) resulted in six main clusters (Table 5). Most mothers belonged to the health-oriented clusters: 'fat conscious'; 'modern,

Table 4. Consumption statistics of main food groups (g/d measured by 3-d food records) in the dietary clusters of 6-year-old children
(Mean values and interquartile ranges)

	Modern, healthy (*n* 283)		Traditional (*n* 360)		Fast food, sweets (*n* 198)	
Food group	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range
Bakery savoury	20	0–32	21	0–33	36	0–56
Bakery sweet	24	4–36	27	8–39	30	8–44
Bread, whole cereal	59	35–77	45	25–61	38	21–49
Pizza	10	0–0	11	0–0	16	0–17
Porridge	103	36–143	105	10–161	65	0–107
Berry dishes	58	3–98	48	0–71	37	0–50
Fruit, fresh	61	16–89	51	3–81	40	0–64
Meat dishes	126	67–167	137	64–190	108	50–150
Fish dishes	27	0–33	21	0–27	14	0–17
Milks, skimmed, low-fat	304	67–469	101	0–158	197	0–333
Milks, high-fat	168	0–250	362	183–517	170	0–247
Potato	66	27–100	75	33–107	49	18–72
Potato, fried	6	0–0	8	0–0	22	0–33
Drinks, berry-based	90	0–133	154	31–233	92	11–133
Sweetened beverages	31	0–50	44	0–67	109	0–167
Drinks, water	107	0–167	95	0–133	164	33–244
Nuts, dried fruit, chips	2	0–1	2	0–1	7	0–10
Sweets, sugar	18	3–25	19	5–26	26	7–38
Dairy spread	2	0–1	4	0–7	4	0–5
Fat spread, margarine	12	6–16	8	2–12	7	3–11
Vegetables, fresh	40	13–60	34	7–47	32	9–41

Table 5. Consumption statistics of main food groups (g/d by a FFQ) by the six clusters in the mothers of the Diabetes Prediction and Prevention Nutrition Study included in hierarchical cluster analysis (Mean values and interquartile ranges)

	Fat conscious (*n* 1144)		Modern, healthy (*n* 887)		Small amounts (*n* 1240)		Fast food, plenty (*n* 418)		Refined, sugar and butter (*n* 607)		Fast food, sweets (*n* 566)	
Food group	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range	Mean	Interquartile range
Bakery sweet, high-fat	17	7–23	18	8–25	18	7–23	44	18–57	33	14–40	29	10–39
Bakery sweet, low-fat	22	7–29	27	10–36	27	7–36	41	14–57	52	16–64	25	7–32
Bakery savoury	16	8–21	22	10–28	14	6–18	32	13–38	25	12–32	20	8–25
Bread, dark	88	36–140	100	54–142	80	35–110	81	35–110	89	37–140	62	19–82
Bread, white	62	21–90	68	30–93	70	21–94	79	34–111	92	44–120	72	26–120
Berries	34	10–45	65	21–79	31	7–41	64	19–81	55	15–70	26	5–33
Fruit juice	221	66–340	242	73–340	237	49–340	442	181–594	255	73–351	294	73–400
Fruits	261	135–343	296	162–385	188	82–233	380	167–470	234	115–297	224	93–300
Meat cuts	20	7–30	22	7–30	24	7–32	40	18–51	34	12–48	30	11–43
Meat dishes	98	59–129	111	59–148	95	59–125	170	109–211	122	72–158	90	53–122
Meat poultry	46	26–53	49	26–53	26	12–26	51	26–79	33	12–53	35	18–53
Sausage	20	6–24	19	6–24	20	11–24	40	24–49	30	11–49	25	11–24
Fast food	23	11–31	25	13–34	21	11–27	57	30–71	32	16–39	37	21–46
Fish	46	23–61	65	34–87	31	15–44	68	34–92	45	22–61	33	12–46
Milks, low-fat	268	0–510	268	0–510	215	0–340	268	0–510	257	0–510	183	0–340
Milks, high-fat	51	0–17	78	0–49	197	0–340	159	0–170	186	0–340	150	0–170
Milks, sour low-fat	123	34–169	108	18–133	49	0–71	124	21–146	73	4–102	64	0–102
Cheese, low-fat	28	2–46	26	3–34	6	0–7	19	2–23	10	0–8	10	0–8
Cheese, regular	30	4–43	41	10–61	49	14–64	51	16–70	52	17–74	44	11–61
Potato	82	56–111	97	56–130	97	56–130	108	56–130	109	56–130	71	37–93
Potato, fried	15	5–21	15	5–21	14	5–21	38	21–46	20	10–26	22	10–26
Roots	44	13–53	64	24–78	25	7–32	54	21–71	40	13–48	24	7–30
Coffee	169	0–240	170	0–240	219	4–360	221	0–360	225	4–360	216	0–360
Tea	130	10–150	185	25–300	113	5–150	157	20–300	155	10–300	93	10–150
Beer	6	0–0	6	0–0	4	0–0	13	0–0	6	0–0	8	0–0
Chips, dried fruit, nuts	4	0–6	4	0–5	4	0–5	13	5–11	6	0–7	10	2–11
Beverages, light	34	0–43	43	0–33	24	0–22	102	0–94	36	0–33	120	0–141
Beverages, sugared	38	0–47	37	0–47	36	0–47	140	11–189	53	0–76	144	0–189
Sugar	7	2–10	12	2–15	7	2–10	15	4–20	16	3–20	8	2–10
Sweet	9	3–11	7	3–11	8	4–11	21	7–25	10	4–14	15	6–21
Chocolate	45	8–57	43	9–55	53	13–58	82	29–100	73	18–79	72	21–80
Dairy spread	1	0–0	3	0–1	2	0–0	3	0–2	15	0–24	5	0–3
Fat spread, low-fat	7	0–12	8	0–12	6	0–6	5	0–6	8	0–9	6	0–9
Fat spread, high-fat	5	0–7	5	0–6	11	0–18	11	0–18	6	0–3	6	0–9
Vegetables	112	57–136	150	81–191	75	35–105	143	76–184	116	56–156	88	42–115
Vegetables, leafy	37	14–50	55	28–68	19	5–29	49	21–65	34	11–46	22	6–34

healthy'; or 'small amounts'. Unfavourable dietary elements belonged to the clusters 'fast food, plenty', 'refined, sugar and butter' and 'fast food, sweet' of mothers.

Some familial dependence on dietary clusters was observed in mother–child pairs of 6-year-old children ($P=0.035$) but not in younger children (Table 6). In 6-year-old children, the cluster 'healthy, low-fat' had a high proportion in the clusters 'fat conscious' and 'modern, healthy' of mothers. A higher frequency than expected was observed for children being members of the cluster 'fast food, sweet' when mother belonged to the cluster 'fast food, plenty', 'refined, sugar and butter' or 'sweet, fast food'. Marginal significance of familiality ($P=0.054$) at the age of 3 years was observed within child–mother dyads. At the age of 1 year, no indication of familiality was observed.

Associations of social background factors with the dietary patterns were studied for the clusters representing convenience foods, i.e. 'ready-to-eat baby-food' and 'fast foods, sweets' in the age groups of children (Table 7). At the age of 1 year, the cluster 'ready-to-eat baby foods' was prominent for boys and children cared at home, but the cluster was not associated with maternal characteristics. Maternal characteristics, young age and low basic or professional education of the mother, were associated with the cluster 'fast food, sweet' of the child at the age of 3 years. None of the background factors was associated with the cluster 'fast food, sweet' at the age of 6 years.

Discussion

The consistency between the dietary clusters of the children and their mothers was obvious in the age group of 6-year-olds. Both the clusters 'healthy, low-fat' and the cluster 'fast food, sweet' in children had a higher frequency than expected in the corresponding clusters of mothers. This is consistent with the earlier results. Similarities in the child–mother pairs have been observed for a prudent diet[7], fruits and vegetables[4,6], regulation of less-healthy foods[1] but also for high-sugar beverages[2,5]. However, the maternal background was not associated with the convenient dietary cluster of that age in the present study, which may also imply the increasing independency of the child in food selections.

The young age and low education of the mother was associated with the convenient dietary cluster only in 3-year-olds. The weak association between convenient dietary clusters in pre-school children and maternal background may result from great differences in dietary habits by age during years of transition from breast-feeding to family food. In previous studies[2,4–6,8], some dependence between food consumption of the children and maternal characteristics has been reported. High maternal education associated by earlier studies with healthy food pattern[7,9,24,27,29] and fibre intake[37], and young age with consumption of high-sugar foods and drinks[8].

For infants and small children, mothers might serve meals or special servings, which may better follow dietary guidelines or assumed guidelines[1]. In 1-year-old children of the present study, this may be associated with the cluster 'ready-to-eat baby foods'. In a European comparison, parents in many countries preferred home-made food for their infants[7,13,14] but in Finland, the manufactured baby food products (fruit purée, baby meat products and baby porridge) were served to half of the infants according to the present results as well

Table 6. Consistency in dietary clusters of child–mother dyads (*n* 2134)

Clusters of mothers				
			Clusters of 1-year-old children (χ^2 $P=0.286$)*	
	Healthy (*n* 134)	Traditional (*n* 247)	Ready-to-eat baby foods (*n* 298)	Total percentage
Fat conscious (*n* 184)	31	22	30	27
Modern, healthy (*n* 128)	20	21	16	19
Small amounts (*n* 163)	20	29	21	24
Fast food, plenty (*n* 51)	9	7	7	8
Refined, sugar and butter (*n* 67)	10	9	10	10
Sweet, fast food (*n* 86)	10	11	15	13
	100	100	100	100
			Clusters of 3-year-old children (χ^2 $P=0.054$)	
	Healthy (*n* 174)	Traditional (*n* 126)	Fast food, sweet (*n* 355)	
Fat conscious (*n* 179)	25	32 ↑†	28	27
Modern, healthy (*n* 127)	18	22	19	19
Small amounts (*n* 159)	28 ↑	20 ↓	19 ↓	24
Fast food, plenty (*n* 46)	8	7	5	7
Refined, sugar and butter (*n* 75)	12	6 ↓	16 ↑	14
Sweet, fast food (*n* 69)	9 ↓	12	13 ↑	10
	100	100	100	100
			Clusters of 6-year-old children (χ^2 $P=0.035$)	
	Healthy, low-fat (*n* 270)	Traditional (*n* 340)	Fast food, sweet (*n* 190)	
Fat conscious (*n* 181)	26 ↑	20	22	23
Modern, healthy (*n* 143)	23 ↑	14 ↓	18	18
Small amounts (*n* 215)	25	31 ↑	23 ↓	27
Fast food, plenty (*n* 68)	7 ↓	9	9 ↑	9
Refined, sugar and butter (*n* 115)	10 ↓	16	17 ↑	14
Sweet, fast food (*n* 78)	9	9	11	10
	100	100	100	100

The cell values are proportions (%) of the children in clusters of their mothers.
* In 1-year-old infants, the differences are not marked.
† Arrows indicate the differences between the observed and expected cell frequencies that contribute a value of ≥1 to the χ^2-test statistic. The arrow ↑ shows a larger observed frequency and ↓ shows a smaller observed frequency than expected in 3- and 6-year-old children.

Table 7. Proportions (%) of the membership in convenient dietary clusters of children by selected background factors descriptive for the mother–child dyads

	Ready-to-eat baby foods cluster in 1- year-olds (*n* 298)	Fast food, sweets cluster in 3- year-olds (*n* 355)	Fast food, sweets cluster in 6- year-olds (*n* 190)
Sex	$P = 0.034$*	$P = 0.855$	$P = 0.991$
Boy	47	54	24
Girl	40	55	24
Day care	$P = 0.002$*	$P = 0.098$	$P = 0.074$
No	46	56	27
Yes	24	51	22
Maternal age (years)	$P = 0.186$	$P = 0.040$*	$P = 0.179$
< 27	40	62	22
27–31	43	50	23
> 31	49	52	27
Maternal basic education	$P = 0.430$	$P = 0.002$*	$P = 0.280$
Less than high school	46	62 %	26 %
High school	43	49 %	23 %
Maternal professional education	$P = 0.741$	$P = 0.001$*	$P = 0.429$
Secondary or less	45	58	24
University studies or degree	43	43	23

*P values indicate that the variable was significant at the 10 % level in a multiple logistic regression model after the variable selection procedure.

as in previous Finnish studies[10–12]. On the contrary, the infant guideline dietary pattern had negative coefficients for manufactured baby food in the UK[7].

Three dietary clusters were sufficient for the interpretation of the present results among the children studied. The earlier Finnish study, applying the cluster analysis in 7-year-old children[25], identified four clusters 'cereals', 'sugar and sweets', 'bread and skimmed milk' and 'dairy', which corresponded rather well with the present results in 6-year-old children. The health-conscious pattern as well as fast-food or junk-food pattern have been identified in children by the cluster analysis[24,25] and principal component analyses[7,27–29] in other countries. The basic methodology of the cluster analysis is to group individuals, whereas the factor analysis is to group the variables (foods)[38]. The cluster analysis was preferred because it may be easier to interpret as each individual belongs to one cluster only and because it is more applicable to the risk analysis later[38]. The present results from the hierarchical cluster analysis in the mothers were partly similar to our previous factor analysis findings from a subpopulation of the same mothers[35]. At least, the factors 'healthy', 'low-fat foods' and 'fast food' overlapped the clusters of the present study.

The dietary clusters of the children were based on the FR of 3 d and, obviously, they do not reflect the whole variety or habits of food selection. Weekend days may differ in the children's diet from that of weekdays[21], but this was controlled for in the present study by guiding the diary recording to cover one weekend day and two weekdays. There are limitations in the present study design to define associations in dietary clusters within mother–child dyads. The study protocol did not give the best opportunity to find the association between the diet of 6-year-old children and their mothers. Our sample may be selected towards a more healthy food behaviour and due to drop-outs the selectivity may be the strongest at the age of 6 years. Furthermore, the background and the diet of the mothers were collected at the time of birth which may hinder the association with the diets of 6-year-olds. The children studied in the present paper are carrying increased genetic susceptibility for type 1 diabetes but the dietary clusters correspond to the earlier Finnish results[25]. The duration of breast-feeding[11] in the DIPP children also corresponded to the general impression[10]. We know little about how parents react to information about increased genetic risk, but it has been shown that information caused no differences at anxiety levels in the parents of high-risk infants compared with the parents of low-risk infants[39].

The type of day care, at home or in kindergarten, seemed to influence the food behaviour, since the proportion of subjects in the cluster 'fast food, sweets' was the lowest among children cared in kindergarten. The present results give evidence for a better dietary quality in children cared outside home[19], but the results are not consistent and vary by nutrient[19,21]. Day care outside home covers a considerable proportion of daily food consumption but may be more common for older and more educated mothers. Mothers may have difficulties in putting dietary guidelines into practice at home[1,14,18,20]. Dietary counselling has been reported more frequently by nurses than by mothers in visits to child health-care clinics[18]. It can be speculated that dietary counselling may not face the practical needs of the family or mothers are too stressed or preoccupied to notice all guidelines offered to them.

None of the infant clusters was associated with the dietary clusters of the mother. Neither the 'ready-to-eat baby foods' cluster in 1-year-old children in the present study was associated with maternal characteristics. Thus, the present results do not confirm previous results[7]. Complementary feeding of infants has been started too early compared with the guidelines in many countries[12,14]. The high frequency and early introduction of baby foods may give a reason for studying the effects of convenient food habits on later food habits in longitudinal studies. The cross-sectional study design of the present study did not allow for studying longitudinal trends in childhood dietary patterns.

As a conclusion, the present results confirm the concern of consumption of fast foods and high-sucrose sweets and bakery in pre-school children[21,23,26], and therefore the parents

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must be aware of the effect of food available at home. Parents should be encouraged to provide their children healthy food and ensure availability of fruits and vegetables in forms that support the increasing self-regulation of the child.

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