

Changes in socio-economic differences in food habits over time

Tina Seiluri*, Eero Lahelma, Ossi Rahkonen and Tea Lallukka

Hjelt Institute, Department of Public Health, University of Helsinki, PO Box 41, FIN-00014, Helsinki, Finland

Submitted 24 February 2010; Accepted 25 February 2011; First published online 4 May 2011

Abstract

Objective: To examine absolute socio-economic differences in food habits and their changes over time.

Design: A longitudinal study using the cohort baseline mail surveys conducted in 2000–2002 (n 8960, response rate 67%) and the follow-up in 2007 (n 7332, response rate 83%), including data on seven food habits recommended in the national dietary guidelines, as well as socio-economic and sociodemographic variables.

Setting: Data from the Helsinki Health Study survey, followed up for 5–7 years.

Subjects: Municipal employees of the City of Helsinki, Finland.

Results: Apart from fish and vegetable-based margarine on bread, the proportions of the recommended food items were higher for women than for men. The consumption of the recommended food items either increased or remained stable over the follow-up period. On the basis of the slope index of inequality (SII) it was observed that socio-economic differences widened with regard to the consumption of fresh vegetables and fish and use of vegetable-based margarine or oil in cooking, with the upper classes consuming these foods more often. The largest differences were observed in the consumption of fresh vegetables, for which the SII value among women was 2.38 (95% CI 1.93, 2.95) at baseline and 2.47 (95% CI 2.01, 3.03) at follow-up, and 3.36 (95% CI 1.80, 6.28) and 3.47 (95% CI 1.95, 6.19) for men, respectively. Socio-economic differences were non-existent for milk, and the reverse was observed for dark bread and vegetable-based margarine on bread.

Conclusions: Consumption of the recommended food items increased in the examined cohort over time. This increase was mostly similar throughout the socio-economic groups and thus the socio-economic differences remained stable. The upper classes followed the guidelines better with regard to the consumption of vegetables and fish and in the use of vegetable-based margarine or oil in cooking.

Keywords

Food-based recommendations
Occupation class
Socio-economic position
Employees
Cohort

The present study is focused on changes in the socio-economic differences in food habits based on the Finnish National Dietary Guidelines^(1,2), which aim at promoting healthy eating. Although dietary guidelines vary by country because of the local food traditions and the socio-cultural factors related to eating, many common features can also be identified, such as frequent consumption of vegetables, fruit and berries and wholegrain cereals, and use of unsaturated vegetable oil for cooking and soft margarine on bread^(3–7). Following the dietary guidelines is likely to contribute to healthier food habits and will thereby help prevent major diseases. Nevertheless, the consumption of healthy food items and related risks for CVD⁽⁸⁾, diabetes and obesity⁽⁹⁾ vary between socio-economic groups.

In Finland, as well as elsewhere, following the recommended food habits tends to be more common among individuals in higher socio-economic positions^(10–13); however, this is not completely consistent for all food habits⁽¹⁴⁾. Thus, people in higher socio-economic groups

consume less traditional foods such as dark rye bread⁽¹⁵⁾, but more fresh vegetables⁽¹⁶⁾. In Finland, the daily consumption of vegetables has increased mainly in the lower socio-economic groups, and, as a result, the socio-economic differences have narrowed. The positive development among the higher socio-economic groups has, however, been slowing down or has even stagnated⁽¹⁶⁾.

For milk consumption, similar socio-economic differences have not been found⁽¹⁷⁾; however, in Finland, milk is consumed more in the lower than in the higher socio-economic groups⁽¹⁸⁾. In the pooled European data, people in the lower socio-economic groups had a higher intake of total fat and saturated fat compared with their higher group counterparts⁽¹⁹⁾. In Finland, the socio-economic differences in the intake of fat have been small or non-existent⁽¹⁴⁾, but the use of vegetable oil for cooking is more prevalent in higher socio-economic groups⁽²⁰⁾. Moreover, the consumption of fish is more common among higher socio-economic groups⁽²¹⁾.

*Corresponding author: Email tina.seiluri@helsinki.fi

Few studies have simultaneously examined the associations between socio-economic position and several food items. Previous studies have typically focused on a single item or a couple of items at a time and these have usually been fruit and vegetables. Among the single food items, fresh vegetables and fruit are recommended choices; however, it is important to have information on other food habits as well. Some other recommended food items, e.g. bread, show inconsistent differences by socio-economic position⁽¹⁴⁾. Thus far, few longitudinal follow-up studies have been conducted on changes in socio-economic differences in food habits over time. A longitudinal design allows the examination of changes over time in the same participants. Furthermore, socio-economic position was obtained from our baseline and food habits from both baseline and follow-up surveys. This design is stronger than that of a single cross-sectional study, or of repeated cross-sectional studies, and provides more reliable information on changes over time.

Our study aims to fill the gaps in research by analysing longitudinal data that include a broad repertoire of food items by socio-economic position. The main aim was to examine in absolute terms occupational class differences in seven recommended food habits and their changes over time among both female and male employees. More specifically, we examined whether socio-economic differences in food habits followed a linear pattern and whether the differences had narrowed or widened over a follow-up period of 5–7 years.

Methods

Data

Data were derived from the Helsinki Health Study cohort mail questionnaire surveys administered to employees of the City of Helsinki, Finland. At baseline (2000–2002), there were a total of 8960 employees aged 40–60 years (80% women, with a response rate of 67%)⁽²²⁾. The municipal sector in Finland, including the City of Helsinki, is dominated by female employees. Our data reflect the gender distribution among the staff of the City of Helsinki.

The follow-up survey was conducted in 2007 among the respondents to the baseline survey. There were 7332 respondents at follow-up which indicates a response rate of 83%. By follow-up, a part of the study population had retired (21%) or had changed their employer (9%). For the baseline survey, an analysis of the non-response⁽²³⁾ showed that the data are broadly representative of the target population, 40–60-year-old employees of the City of Helsinki, and that the non-response is unlikely to bias the relationships between the socio-economic position and health-related variables in these data.

For the present study, we excluded women who were pregnant or unsure of pregnancy at baseline (seventeen and eight, respectively). The analyses were carried out

among those with complete data on occupational class (data were missing for 125 employees). After the exclusions, the final data consisted of 5853 women and 1329 men. The percentage of missing values was <2% for each food habit. Thus, the number of respondents differed slightly among the different variables.

Measuring food habits

The consumption of various food items was measured according to the frequency of consumption. An FFQ was included in the questionnaire. Respondents were asked to estimate how often they had consumed seven selected food items during the past 4 weeks. The response alternatives were the following: not during the past 4 weeks, 1–3 times/month, 1 time/week, 2–4 times/week, 5–6 times/week, 1 time/d or ≥ 2 times/d. In addition, the respondents were asked which type of fat they typically consumed on bread and in cooking.

The current Finnish national dietary guidelines on recommended food habits were used to select the food items to be studied and to assess the extent to which these recommendations were followed^(1,2). On the basis of these guidelines, the following seven food habits were included: (i) consumption of fresh vegetables at least 2 times/d; (ii) consumption of fresh fruit and/or berries at least 2 times/d; (iii) consumption of dark bread such as rye bread at least 2 times/d; (iv) consumption of fish at least 2 times/week; (v) drinking low-fat or skimmed milk daily (but not drinking high-fat milk daily); (vi) using vegetable-based soft spread on bread; and (vii) using vegetable-based oil or soft margarine in cooking and baking. Each food habit was dichotomised into those that met the recommendations and those that did not.

Socio-economic position

Occupational social class was used as an indicator of socio-economic position. Information on occupational class was derived from the City of Helsinki personnel registers for those who gave written permission for the linkage (77%)⁽²²⁾. For the rest, occupational data were completed from the questionnaires. Respondents were classified into four hierarchical occupational classes: professionals, semi-professionals, routine non-manual employees and manual workers.

Professionals include those with an academic degree, as well as managers who have subordinates and perform managerial or administrative work. Semi-professionals include nurses, technicians and others engaged in similar occupations. Routine non-manual employees include clerical employees and non-professionals within the social- and health-care systems and elsewhere. Typical manual occupations include cleaning and kitchen work, as well as employment in public transport. Among women, 27% were professionals, 20% were semi-professionals, 40% were routine non-manual employees and 14% were manual

workers. Among men, the corresponding figures were 45%, 20%, 10% and 25%, respectively.

Statistical analyses

All analyses were carried out separately for women and men. First, the age-adjusted proportions and 95% CI were calculated for the food items by occupational class. Statistical significance was judged from 95% CI, i.e. by determining whether or not confidence intervals between classes were overlapping. Socio-economic differences were then examined using the slope index of inequality (SII)⁽²⁴⁾ on the basis of a logistic regression analysis, and adjusted for age. The occupational classes were ordered from the lowest to the highest. The cumulative percentages of classes were taken into account and a mean of their range was then calculated for each occupational class. For example, if the proportion of professionals was 28%, the range of individuals in this category was from 0.00 to 0.28; this yielded a mean of 0.14, which was assigned to the professionals. To continue, if the proportion of semi-professionals was 19%, the range was from 0.28 to 0.47, which yielded a mean of 0.38, and so on⁽²⁴⁾. This reclassified variable was then entered in the logistic regression model as a continuous variable and the estimates (OR) produced are shown in Tables 2 and 3. Each of the seven food habits, one at a time, was used as the dependent variable.

The SII provides a score based on the midpoint of the range of occupational class in the cumulative distribution of the population⁽²⁴⁾. The SII can be interpreted as the absolute effect on food habits as a result of moving from the lowest occupational class through the intermediate to the highest one. When the SII value is >1, there is a gradient showing that food habits are poorer in the lower classes. When the SII value is <1, the gradient is the opposite, indicating that the lower classes follow the guidelines better. An increase in SII suggests that the absolute differences between the classes have widened over time, and a decrease suggests that the differences have narrowed.

Logistic regression analysis was used to test the linearity of the occupational class differences in each food habit. Occupational class was used as a continuous variable

and the model was adjusted for age. The occupational class differences were regarded as statistically significant when the *P* value for the trend test was <0.05. Analyses were conducted using the Statistical Package for the Social Sciences statistical software package version 15.0 (SPSS Inc., Chicago IL, USA).

Results

Women followed the recommended food habits more often than men (Table 1). Among both women and men, the consumption of most food items increased over the follow-up period. For women, the lowest proportion occurred for their consumption of fruit and berries at least 2 times/d, with 26% at baseline and 30% at follow-up. For men as well, the lowest proportion was for fruit and berries, with 9% and 11%, respectively. Approximately 80% of both women and men reported that they typically use vegetable-based margarine or oil in cooking and baking.

Socio-economic differences in food items

At baseline, more women in the higher socio-economic groups than in lower groups consumed fresh vegetables, fruit and berries at least 2 times/d, consumed fish at least 2 times/week and used vegetable-based margarine or oil in cooking and baking (Table 2). However, more women in the lower socio-economic groups used vegetable-based margarine on bread. In addition, the intermediate classes were most often the consumers of dark bread at least 2 times/d. There were no baseline differences between the socio-economic groups with regard to women's consumption of low-fat or skimmed milk.

At follow-up, the women in each socio-economic group showed an increase in the consumption of each food item as compared with baseline. Nevertheless, some of these changes did not reach statistical significance. For consumption of fresh vegetables at least 2 times/d, the increase was greatest among professionals and among routine non-manual employees. Fruit and berry consumption also increased the most among routine non-manual employees.

Table 1 The proportions (%) and 95% CI of women and men who followed each recommended food habit at baseline (2000–2002) and follow-up (2007)

	Women (n 5853)				Men (n 1329)			
	Baseline		Follow-up		Baseline		Follow-up	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Fresh vegetables at least 2 times/d	27	26.0, 28.2	32	31.0, 33.4	13	10.8, 15.4	16	13.6, 18.5
Fruit and/or berries at least 2 times/d	26	25.2, 27.3	30	29.0, 31.2	9	6.5, 11.0	11	8.3, 13.0
Dark bread at least 2 times/d	44	42.9, 45.5	48	46.6, 49.1	33	30.5, 35.8	38	35.1, 40.5
Fish at least 2 times/week	36	34.5, 37.0	42	40.6, 43.2	36	33.2, 38.4	39	35.9, 41.2
Low-fat or skimmed milk daily	45	43.3, 45.8	49	47.4, 50.0	40	37.0, 42.3	41	38.7, 44.1
Vegetable-based margarine on bread	64	62.8, 65.2	71	69.5, 71.8	65	62.6, 67.7	70	67.7, 72.7
Vegetable-based margarine or oil in cooking or baking	75	73.9, 76.1	82	80.9, 82.8	78	76.1, 80.7	84	81.7, 85.8

Table 2 Occupational class differences in food habits among women at baseline (2000–2002) and follow-up (2007)

	Professionals		Semi-professionals		Routine non-manual employees		Manual workers		SII	95% CI
	%	95% CI	%	95% CI	%	95% CI	%	95% CI		
Fresh vegetables at least 2 times/d										
Baseline	32	29.5, 33.9	31	28.7, 33.8	23	21.5, 25.2	19	15.8, 22.0	2.38	1.93, 2.95
Follow-up	38	35.5, 40.2	36	33.3, 38.8	28	26.1, 29.9	23	19.8, 26.4	2.47	2.01, 3.03
Fruit and berries at least 2 times/d										
Baseline	28	26.2, 30.5	31	28.7, 33.8	24	22.4, 26.1	20	16.5, 22.6	1.81	1.46, 2.24
Follow-up	31	29.0, 33.6	36	33.0, 38.3	29	27.0, 30.8	20	17.1, 23.5	1.78	1.45, 2.19
Dark bread at least 2 times/d										
Baseline	40	37.1, 42.0	46	42.9, 48.7	47	44.7, 48.8	43	39.4, 46.3	0.77	0.63, 0.92
Follow-up	43	40.4, 45.3	51	47.9, 53.7	50	48.1, 52.2	45	41.6, 48.6	0.81	0.67, 0.98
Fish at least 2 times/week										
Baseline	42	39.7, 44.5	40	36.9, 42.5	32	29.8, 33.7	30	26.8, 33.5	2.15	1.77, 2.62
Follow-up	47	44.7, 49.6	47	44.1, 49.8	38	36.2, 40.3	33	30.0, 36.9	2.14	1.76, 2.59
Low-fat/skimmed milk daily										
Baseline	44	41.8, 46.8	46	42.9, 48.7	44	41.9, 46.1	45	41.5, 48.6	1.01	0.83, 1.22
Follow-up	50	47.5, 52.5	53	50.4, 56.3	47	45.0, 49.2	48	44.7, 51.8	1.23	1.01, 1.48
Vegetable-based margarine on bread										
Baseline	57	55.1, 59.8	63	60.7, 66.2	67	65.2, 69.2	67	64.1, 70.8	0.54	0.45, 0.66
Follow-up	64	62.2, 66.7	71	68.5, 73.8	74	71.8, 75.6	74	71.0, 77.3	0.53	0.43, 0.65
Vegetable-based margarine or oil in cooking or baking										
Baseline	80	78.0, 82.3	80	77.7, 82.7	71	69.0, 72.6	67	64.0, 70.0	2.71	2.17, 3.37
Follow-up	86	84.1, 87.9	86	83.5, 88.0	79	77.4, 80.6	76	73.2, 78.5	2.57	2.01, 3.29

SII, slope index of inequality.

Age-adjusted proportions (%) of those who followed each recommended food habit, SII and 95% CI (*n* 5853).

As for the daily consumption of low-fat milk, an increase was found among professionals and semi-professionals. Furthermore, each socio-economic group increased the use of margarine on bread. Among those engaged in various professions, manual workers increased their use of vegetable-based margarine or oil in cooking the most.

The SII confirmed the socio-economic differences found for the consumption of fresh vegetables, fruit and berries and fish and for the use of vegetable-based margarine or oil in cooking. In addition, stable reverse socio-economic differences were confirmed for the use of vegetable-based margarine on bread and dark bread. Among women, the largest socio-economic differences were found in their consumption of fresh vegetables and in the use of vegetable-based margarine or oil in cooking and on bread. However, no differences occurred between socio-economic groups in the consumption of low-fat milk. The socio-economic differences in all studied food items remained largely unchanged over time.

Among women, the linear trend test was statistically significant for each food habit, except for milk at baseline ($P=0.941$), confirming that differences between the occupational classes were otherwise linear. This can be judged from Table 2 as well.

At baseline, more men in higher socio-economic groups than in lower groups consumed fresh vegetables and fish and used vegetable-based margarine or oil in cooking and baking (Table 3). No socio-economic differences occurred in the consumption of fruit and berries, low-fat or skimmed milk and in the use of vegetable-based margarine on bread. Similar to women, more men

in the lower classes also consumed low-fat or skimmed milk and dark bread and used vegetable-based margarine on bread. Among men, the changes over time in the socio-economic differences in food habits were small and did not reach statistical significance.

The SII confirmed the socio-economic differences for consumption of fresh vegetables and fish and for the use of vegetable-based margarine or oil in cooking and baking, with the higher socio-economic groups opting for these food items more often. At follow-up, there were no absolute differences between the socio-economic groups in their consumption of fruit and berries and low-fat milk and in their use of vegetable-based margarine on bread. The largest socio-economic differences were in the consumption of fresh vegetables and fish and in the use of vegetable-based margarine or oil in cooking. As for women, the socio-economic differences in all their food habits remained largely unchanged over time. However, the differences between socio-economic groups somewhat increased for consumption of fruit and berries.

Among men, the trend tests confirmed that differences among occupational classes were linear in most cases. This can be judged from Table 3 as well. Because of the lower numbers of men, some of the trend tests did not reach statistical significance.

Discussion

The present study used a longitudinal design to examine socio-economic differences and their changes over time

Table 3 Occupational class differences in food habits among men at baseline (2000–2002) and follow-up (2007)

	Professionals		Semi-professionals		Routine non-manual employees		Manual workers		SII	95% CI
	%	95% CI	%	95% CI	%	95% CI	%	95% CI		
Fresh vegetables at least 2 times/d										
Baseline	17	14.2, 19.7	12	7.5, 15.7	10	4.1, 15.6	9	5.0, 12.4	3.36	1.80, 6.28
Follow-up	21	17.6, 23.6	14	9.8, 18.0	11	4.7, 17.0	11	6.8, 14.8	3.47	1.95, 6.19
Fruit and berries at least 2 times/d										
Baseline	10	7.5, 12.3	8	4.4, 11.3	9	4.2, 14.1	9	6.1, 12.4	1.17	0.59, 2.33
Follow-up	13	10.1, 15.2	9	5.1, 12.7	11	5.6, 16.2	9	5.1, 11.9	1.93	1.00, 3.71
Dark bread at least 2 times/d										
Baseline	29	25.4, 33.1	33	27.5, 38.9	34	25.9, 42.1	41	35.4, 45.7	0.49	0.32, 0.74
Follow-up	34	30.3, 38.3	40	34.6, 46.3	40	31.9, 48.3	41	35.3, 46.0	0.64	0.43, 0.97
Fish at least 2 times/week										
Baseline	42	38.2, 46.1	35	28.8, 40.3	34	26.2, 42.6	28	22.3, 32.9	2.56	1.68, 3.91
Follow-up	45	41.5, 49.4	38	44.1, 49.8	37	28.6, 45.1	28	22.6, 33.2	2.96	1.95, 4.48
Low-fat/skimmed milk daily										
Baseline	41	36.6, 44.5	40	33.7, 45.5	37	28.6, 45.3	38	32.7, 43.5	1.19	0.79, 1.79
Follow-up	42	37.6, 45.6	42	36.2, 48.1	40	31.4, 48.2	41	35.7, 46.6	1.04	0.69, 1.56
Vegetable-based margarine on bread										
Baseline	64	59.7, 67.5	63	57.5, 69.0	68	59.7, 76.1	66	61.0, 71.5	0.83	0.54, 1.25
Follow-up	70	66.0, 73.5	69	63.3, 74.3	70	62.0, 77.4	72	67.3, 77.3	0.86	0.56, 1.33
Vegetable-based margarine or oil in cooking or baking										
Baseline	83	79.3, 86.1	77	72.1, 82.1	75	68.3, 82.4	72	67.5, 76.6	2.54	1.58, 4.10
Follow-up	87	84.1, 90.1	83	78.5, 87.4	81	75.1, 87.6	79	74.6, 82.7	2.50	1.47, 4.26

SII, slope index of inequality.

Age-adjusted proportions (%) of those who followed each recommended food habit, SII and their 95% CI (*n* 1329).

in the seven food habits recommended in the Finnish national dietary guidelines. This was done by following up a large cohort of middle-aged municipal employees for 5–7 years, with the average being 6 years.

Main findings

First, the consumption of each recommended food item increased over time for both women and men. An increase was observed within most socio-economic groups and for most food items among both women and men. The proportions of the different food habits were higher for women than for men, apart from the consumption of fish and use of vegetable-based margarine or oil in cooking and on bread.

Second, the socio-economic differences in food habits remained practically unchanged over time. However, there were socio-economic differences in the consumption of fresh vegetables and fish and in the use of vegetable-based margarine or oil in cooking, with the higher classes consuming these foods more often than their lower-class counterparts. These socio-economic differences were not a factor for the consumption of low-fat or skimmed milk. In contrast, the differences were reversed for consumption of dark bread and for the use of vegetable-based margarine on bread, with the lower groups consuming these foods more often.

Interpretation

Previous studies have not examined changes in the socio-economic differences in food habits using longitudinal

data. However, our results are in line with previous evidence on patterns in socio-economic differences with regard to the consumption of recommended food habits. First, fresh fruit and vegetables are typically consumed more often among those in higher socio-economic positions^(16,25), at least in countries where the availability and affordability of fresh fruit and vegetables are lower. Although changes in socio-economic differences have not been examined earlier, a previous study focused on the consumption trends across several cross-sectional surveys conducted between 1979 and 2002⁽¹⁶⁾. Results of the present study reported narrowing socio-economic differences and a levelling off of the positive development in consumption patterns among those with higher education⁽¹⁶⁾. Our finding suggests stable socio-economic differences in vegetable consumption during more recent years, although our prospective data were not representative of the general population. Second, our results are in line with an earlier study showing that those in lower socio-economic groups consume rye bread more frequently than those in higher groups⁽¹⁵⁾. Third, those in lower socio-economic groups have been found to consume more milk compared with their higher-group counterparts⁽¹⁸⁾; however, the previous studies did not focus on low-fat milk. Thus, our results add to this previous evidence showing that socio-economic differences are absent with regard to the consumption of low-fat milk. Fourth, in line with our findings, people in higher socio-economic groups in Costa Rica were more likely to use unsaturated oil in their cooking⁽²⁶⁾.

As people in higher socio-economic groups tend to follow the recommendations for food habits better, some may have already reached a saturation point; thus, improving their food habits may be difficult^(16,27). In our cohort, however, most women and men in each socio-economic group have changed their food habits in line with the recommendations, which has led to a stable development of socio-economic differences in food habits. The next question is: Why did all groups improve their food habits in a similar way? One reason might be that our study population was relatively homogeneous at baseline, including only middle-aged employees who worked for the same employer and who lived within the Helsinki metropolitan area. The previously adopted food habits might have remained after a change of employer or after retirement. In addition, the overall tendency to improve food habits might be related to secular trends, to general knowledge about healthy eating across the population or to some other specific features of the studied cohort. Further analyses suggest that patterns are similar among those who remained in employment, as well as among those who retired (data not shown).

Furthermore, the criteria for healthy eating in the national nutritional guidelines in the present study are modest. For example, in some other countries, vegetables are recommended to be eaten at least 5 times/d^(4–7). Consequently, the recommended food habits can still be substantially improved. Although the socio-economic differences in food habits remain stable, substantial differences continue to exist, calling for measures to narrow down the socio-economic differences in the recommended food habits in all groups and improve the food habits of the lower socio-economic groups, particularly among men. Moreover, gender differences in the socio-economic patterns of food habits are large, and, for example, for fresh vegetables, almost as many of the men in the highest group followed the recommendations for healthy eating as did the women in the lowest group.

Available income is also important for food habits⁽²⁸⁾. Low prices may be more effective than health education for increasing the consumption of fruit and vegetables⁽²⁹⁾, in particular in a country such as Finland, where the food culture has traditionally not favoured fresh vegetables and where their relative prices are higher than in the Mediterranean countries⁽²⁵⁾. The prices and familiarity of foods disproportionately guide food choices, in particular among people in lower socio-economic groups⁽³⁰⁾, whereas people in higher socio-economic groups are typically more health conscious in their food choices⁽³¹⁾ and may be more aware of the healthy foods available even at a relatively low cost⁽³²⁾. Because all socio-economic groups improved their food habits equally, lowering the prices of the recommended food items is likely to have the largest effect on their consumption, in particular among those with the lowest income⁽²⁸⁾.

Methodological considerations

There were some limitations in the present study. For instance, we were unable to measure any amount of the food items consumed, nor did we have any information on the nutrient contents of the foods. Baseline data were collected in spring and follow-up data in winter, which may influence the frequency of the consumption of fresh vegetables, fruit and berries to a certain extent. Thus, the increase in the consumption of vegetables and fruit might have been larger if the follow-up survey had been conducted in summer. Our FFQ is based on many previous studies^(20,33,34) and applied for the purpose of a broader study on employees' health and health behaviours. Although direct validation has not been carried out, even proxy measures have been shown to reflect following healthy food habits more generally⁽³⁵⁾. Control analyses using education as the socio-economic indicator provided results identical to those for the occupational classes reported here (data not shown).

Furthermore, the response rates (67% and 83%) were acceptable but non-participation is still a challenge and may cause some bias. However, our analysis on the baseline non-response suggests that it does not substantially affect the studied associations⁽²³⁾. The response rate to the follow-up was 83% and we believe that attrition is unlikely to distort our main findings to any large extent. Among those who did not respond at follow-up, the baseline food habits were slightly worse. As those in lower occupational classes were slightly less likely to participate in the follow-up survey compared with their higher-class counterparts, a part of the overall improvements in food habits might be due to attrition. However, all socio-economic groups improved their food habits.

All respondents were from the Helsinki metropolitan area and were employed at baseline by the City of Helsinki. As a consequence, the results cannot be generalised to the whole population of Finland, or even to the employed population at large. With caution, our data can be assumed to represent the municipal sector in general. Typically, socio-economic differences in health-related phenomena are fewer among employees than among general populations, since the latter also include disadvantaged groups such as the unemployed and those who retired because of disability. Nevertheless, our cohort includes a large and diverse population, and the study was planned to enable studies of the socio-economic differences in lifestyles and health. A further strength was that food habits were examined in a follow-up design, which included identical questions at baseline and follow-up.

Conclusions

The consumption of the recommended food habits increased among the examined cohort. Following the recommendations varied by food habits, with women

following recommendations more often than men. There were definite differences between socio-economic groups at baseline and follow-up. The socio-economic differences in food habits remained practically unchanged over time, which means that these differences neither narrowed nor widened. Thus, in these data, irrespective of the socio-economic background, the socio-economic differences in the recommended food habits remained clear but stable during the follow-up period of 5–7 years. Nevertheless, substantial differences between groups continue to exist, calling for efforts to narrow down the socio-economic differences in recommended food habits in general and improve the food habits of the lower socio-economic groups in particular. Every socio-economic group needs to improve to achieve the recommended food habits.

Acknowledgements

The Helsinki Health Study is supported by grants from the Academy of Finland (nos 1129225 and 1121748), the Yrjö Jahnsson Foundation and the Finnish Cultural Foundation. T.L. is supported by the Academy of Finland (Grant no. 133434), the Yrjö Jahnsson Foundation and the Finnish Cultural Foundation. The authors have no conflict of interest to declare. T.S. carried out the statistical analysis, interpreted the results and drafted the manuscript; T.S., E.L., O.R. and T.L. contributed to designing the study, interpreting the results and drafting the manuscript. All the authors critically reviewed the manuscript and approved the final version.

References

- National Nutrition Council (1998) *Finnish Nutrition Recommendations. Committee Report no. 7*. Helsinki: Ministry of Agriculture and Forestry.
- National Nutrition Council (2005) *Suomalaiset Ravitsemussuosittukset – Ravinto ja Liikunta Tasapainoon*. Helsinki: Edita Publishing Oy.
- Nordic Council (2004) *Nordic Nutrition Recommendations, 2004. Integrating Nutrition and Physical Activity*, 4th ed. Denmark: Nord.
- British Nutrition Foundation (2007) Healthy eating. <http://www.nutrition.org.uk/healthyliving/healthyeating> (accessed January 2010).
- US Department of Health and Human Services & US Department of Agriculture (2005) *Dietary Guidelines for Americans 2005*, 6th ed. Washington, DC: US Government Printing Office.
- Health Canada (2007) *Eating Well with Canada's Food Guide. A Resource for Educators and Communicators*. Ottawa: Health Canada.
- National Health & Medical Research Council (2003) *Dietary Guidelines for Australian Adults*. Canberra: Commonwealth of Australia.
- Laaksonen M, Talala K, Martelin T *et al.* (2008) Health behaviours as explanations for educational level differences in cardiovascular and all-cause mortality: a follow-up of 60 000 men and women over 23 years. *Eur J Public Health* **18**, 38–43.
- Everson SA, Maty SC, Lynch JW *et al.* (2002) Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* **53**, 891–895.
- Darmon N & Drewnowski A (2008) Does social class predict diet quality? *Am J Clin Nutr* **87**, 1107–1117.
- Roos E, Sarlio-Lähteenkorva S & Lallukka T (2004) Having lunch at a staff canteen is associated with recommended food habits. *Public Health Nutr* **7**, 53–61.
- Roos E, Lahelma E, Virtanen M *et al.* (1998) Gender, socioeconomic status and family status as determinants of food behaviour. *Soc Sci Med* **46**, 1519–1529.
- Lallukka T, Laaksonen M, Rahkonen O *et al.* (2007) Multiple socio-economic circumstances and healthy food habits. *Eur J Clin Nutr* **61**, 701–710.
- Roos E, Prättälä R, Lahelma E *et al.* (1996) Modern and healthy?: socioeconomic differences in the quality of diet. *Eur J Clin Nutr* **50**, 753–760.
- Prättälä R, Helasoja V & Mykkänen H (2001) The consumption of rye bread and white bread as dimensions of health lifestyles in Finland. *Public Health Nutr* **4**, 813–819.
- Roos E, Talala K, Laaksonen M *et al.* (2008) Trends of socioeconomic differences in daily vegetable consumption, 1979–2002. *Eur J Clin Nutr* **62**, 823–833.
- Sanchez-Villegas A, Martinez JA, Prättälä R *et al.* (2003) A systematic review of socioeconomic differences in food habits in Europe: consumption of cheese and milk. *Eur J Clin Nutr* **57**, 917–929.
- Roos G, Prättälä R & FAIR-97-3096 Disparities Group (tasks 4 and 5) (editors) (1999) *Disparities in Food Habits – Review of Research in 15 European Countries*. Helsinki: National Public Health Institute.
- Lopez-Azpiazu I, Sanchez-Villegas A, Johansson L *et al.* (2003) Disparities in food habits in Europe: systematic review of educational and occupational differences in the intake of fat. *J Hum Nutr Diet* **16**, 349–364.
- Petkeviciene J, Klumbiene J, Prättälä R *et al.* (2007) Educational variations in the consumption of foods containing fat in Finland and the Baltic countries. *Public Health Nutr* **10**, 518–523.
- Akbaraly TN & Brunner EJ (2008) Socio-demographic influences on trends of fish consumption during later adult life in the Whitehall II study. *Br J Nutr* **100**, 1116–1127.
- Lahelma E, Martikainen P, Rahkonen O *et al.* (2005) Occupational class inequalities across key domains of health: results from the Helsinki Health Study. *Eur J Public Health* **15**, 504–510.
- Laaksonen M, Aittomäki A, Lallukka T *et al.* (2008) Register-based study among employees showed small nonparticipation bias in health surveys and check-ups. *J Clin Epidemiol* **61**, 900–906.
- Shaw M, Galobardes B, Lawlor D *et al.* (2007) *3.1.1. Slope Index of Inequality (SII). The Handbook of Inequality and Socioeconomic Position. Concepts and Measures*. Southampton: Hobbs the Printers.
- Prättälä R, Hakala S, Roskam AJ *et al.* (2009) Association between educational level and vegetable use in nine European countries. *Public Health Nutr* **12**, 2174–2182.
- Colon-Ramos U, Kabagambe EK, Baylin A *et al.* (2007) Socio-economic status and health awareness are associated with choice of cooking oil in Costa Rica. *Public Health Nutr* **10**, 1214–1222.
- Prättälä R, Karisto A & Berg MA (1994) Consistency and variation in unhealthy behaviour among Finnish men, 1982–1990. *Soc Sci Med* **39**, 115–122.
- Lallukka T, Laaksonen M & Rahkonen O (2009) Healthy eating: what is the role of the economic situation?. In *Bioactive Foods in Promoting Health*, pp. 99–110 [R Watson and V Preedy, editors]. Oxford: Academic Press.

29. Horgen KB & Brownell KD (2002) Comparison of price change and health message interventions in promoting healthy food choices. *Health Psychol* **21**, 505–512.
30. Steptoe A & Wardle J (1999) Motivational factors as mediators of socioeconomic variations in dietary intake patterns. *Psychol Health* **14**, 391–402.
31. Inglis V, Ball K & Crawford D (2005) Why do women of low socioeconomic status have poorer dietary behaviours than women of higher socioeconomic status? A qualitative exploration. *Appetite* **45**, 334–343.
32. Inglis V, Ball K & Crawford D (2008) Socioeconomic variations in women's diets: what is the role of perceptions of the local food environment? *J Epidemiol Community Health* **62**, 191–197.
33. Grabauskas V, Petkeviciene J, Kriaucioniene V *et al.* (2004) Health inequalities in Lithuania: education and nutrition habits. *Medicina (Kaunas)* **40**, 875–883.
34. Helakorpi S, Laitalainen E & Uutela A (editors) (2008) *Health Behaviour and Health among the Finnish Adult Population, Spring 2007*. Helsinki: National Public Health Institute.
35. Dynesen AW, Haraldsdottir J, Holm L *et al.* (2003) Socio-demographic differences in dietary habits described by food frequency questions – results from Denmark. *Eur J Clin Nutr* **57**, 1586–1597.