Healthy dietary habits in relation to social determinants and lifestyle factors

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The aim of the present study was to evaluate the importance of social status and lifestyle for dietary habits, since these factors may influence life expectancy. We studied the association of four indicators for healthy dietary habits (fruits and vegetables, fibre, fat and Hegsted score) with sex, age, socio-economic status, education, physical leisure exercise, smoking and personal attention paid to keeping a healthy diet. Data were gathered with a self-administered quantitative food-frequency questionnaire distributed to a representative sample of Norwegian men and women aged 16–79 years in a national dietary survey, of whom 3144 subjects (63 %) responded. Age and female sex were positively associated with indicators for healthy dietary habits. By separate evaluation length of education, regular physical leisure exercise and degree of attention paid to keeping a healthy diet were positively associated with all four indicators for healthy dietary habits in both sexes. Socio-economic status, location of residence and smoking habits were associated with from one to three indicators for healthy dietary habits. In a multiple regression model, age, education and location of residence together explained from 1 to 9 % of the variation (R^2) in the four dietary indicators. Length of education was significantly associated with three of four dietary indicators both among men and women. By including the variable 'attention paid to keeping a healthy diet' in the model, R^2 increased to between 4 and 15 % for the four dietary indicators. Length of education remained correlated to three dietary indicators among women, and one indicator among men, after adjusting for attention to healthy diet, age and location of residence. Residence in cities remained correlated to two indicators among men, but none among women, after adjusting for age, education and attention to healthy diet. In conclusion, education was associated with indicators of a healthy diet. Attention to healthy diet showed the strongest and most consistent association with all four indicators for healthy dietary habits in both sexes. This suggests that personal preferences may be just as important for having a healthy diet as social status determinants.

Diet: Social status: Lifestyle

Dietary factors such as total fat, saturated fatty acids and salt are associated with increased risk of cardiovascular diseases and cancer, whereas fibre, fruits and vegetables may decrease this risk (Department of Health and Human Services, 1988; World Health Organization, 1990; Ministry of Health and Social Affairs, 1992; World Cancer Research Fund/American Institute for Cancer Research, 1997). The prevalence of risk factors for cardiovascular diseases (Kaplan & Keil, 1993; Thürmer, 1993) and the mortality from cancer and cardiovascular diseases (Kristofersen, 1986; Blaxter, 1987; Mackenbach *et al.* 1997) are inversely related to socio-economic status. Several studies have shown that groups with high socio-economic status practise more healthy behaviours than low-status groups (Aarø, 1986; Prättälä *et al.* 1994; Lynch *et al.* 1997), and that skewed distribution of health behaviour, including dietary habits, may explain differences in mortality and morbidity between social classes (Holme *et al.* 1980; Jacobsen & Thelle, 1988; Marmot *et al.* 1991; Lynch *et al.* 1996). Socio-economic differences in food consumption have been found in many dietary surveys (Axelson, 1986; Hulshof *et al.* 1991; Smith & Baghurst, 1992), however, differences in nutrient intake tend to be less apparent. For example, the British national dietary survey (Gregory *et al.* 1990), showed that vitamin and mineral intakes, but not fat intake, were related to socio-economic status. A large Finnish survey (Roos *et al.* 1996)

Abbreviation: E %, percentage of dietary energy.

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also showed that socio-economic differences in intake of fat and other macronutrients were small or non-existent; the only substantial differences were found for vitamin C and carotenoids. This is in contrast to the first FINMONICA survey in 1982 (Pietinen *et al.* 1988) which showed that blue-collar *v.* white-collar workers had higher intakes of saturated fatty acids and cholesterol. The Dutch national dietary survey (Hulshof *et al.* 1991), as well as a survey among randomly selected urban Australian adults (Smith & Baghurst, 1992) showed that higher social status was generally associated with healthier dietary intake. However, these differences did not appear to be large enough to be a major explanatory variable for the variation in disease risk between groups.

Commonly-used indicators of socio-economic status in epidemiological surveys have been education, occupation and income (Liberatos *et al.* 1988; Winkleby *et al.* 1992; Kaplan & Keil, 1993). The strongest and most consistent relationships between socio-economic status and risk factors have been found for education (Liberatos *et al.* 1988; Winkleby *et al.* 1992; Luoto *et al.* 1994), and it is also shown that education may be the most important social predictor for a healthy diet (Blaxter, 1990). Several studies suggest that nutritional knowledge and health-related attitudes may be more closely associated with dietary intake than traditional socio-economic characteristics (Hollis *et al.* 1986; Witte *et al.* 1991; Hulshof *et al.* 1992; Smith & Owen, 1992). A number of models have been suggested to explain health behaviour, such as the knowledge–attitude–practice model; social learning theory and health locus of control; the health belief model; the theory of reasoned action; and Bandura's social cognitive theory reinforcements (Mæland & Aarø, 1993). Efforts have been made to integrate elements from the different models, but we still do not have a holistic model that can explain health behaviour. Across the models, the most important regulatory factors for behaviour seem to be social norms, personal expectations and environmental reinforcements (Mæland & Aarø, 1993).

The aim of the present study was to evaluate the importance of social status and lifestyle in determining dietary habits. We examined the relationship between indicators for a healthy diet, and education, socio-economic status, income, location of residence, and some lifestyle variables in a nationwide dietary survey. In addition to classical lifestyle variables, we asked about the degree of attention paid to keeping a healthy diet. This attitude variable was used as an indicator of the participants' personal preferences. We wanted to examine if this attitude had an independent association with the quality of dietary habits.

The main hypotheses to be tested in this report were: (a) healthy dietary habits differ between low and high social status groups, evaluated by length of education and socio-economic status; (b) indicators for healthy lifestyle, such as regular leisure time physical exercise and non-smoking, are associated with healthy dietary habits; (c) the degree of attention paid to keeping a healthy diet is more strongly associated with healthy dietary habits than length of education.

Experimental

Sample

The dietary survey was coordinated with Statistics Norway's Omnibus Surveys and undertaken during June, September and November 1993, and March 1994. A nationwide, representative random sample of 2500 Norwegians aged 16–79 years was drawn for each Omnibus Survey. A random half of each of these samples was invited to participate in the dietary survey, approximately 1250 subjects in each period (Central Bureau of Statistics, 1977; Statistics Norway, 1993). A quantitative food-frequency questionnaire was mailed to the subjects together with information letters about the Omnibus and the dietary survey, later called NORKOST. After 1–3 weeks the questionnaire was collected by personnel from Statistics Norway. Non-responders got one reminder by mail after 4 weeks. For each round of the Omnibus Survey the Norwegian Data Inspectorate was notified according to standard procedures.

Of the original sample for the survey, twenty-eight died or emigrated and were therefore excluded from the sample. Of the remaining 4980 subjects 3227 returned their questionnaire. In total eighty-three questionnaires were rejected, and 3144 (63 %) were used for further analysis. The distribution of subjects in different groups of socio-economic status, location of residence and length of education, were similar in NORKOST compared with the general population (Statistics Norway, 1995). There were only small differences between responders and the total random sample regarding age, sex, geographical distribution and educational level (Johansson *et al.* 1997*a*). However, the response rate was significantly lower in the age group 70–79 years (46 %), among subjects living in cities (59 %) and for subjects with low education (52 %), as compared with the other subjects. A detailed description of the subjects, the questionnaire and the calculation of nutrients is given elsewhere (Johansson *et al.* 1997*a*,*b*).

Questionnaire

The self-administered, optical mark readable quantitative food-frequency questionnaire was designed to cover the whole diet and included about 180 food items. The frequency of consumption was given per day, per week or per month depending on the food item. The portion sizes were units such as slices, glasses, cups, pieces, decilitres and spoons. The portion sizes of the different food items were converted to weights on the basis of standard portions estimated from previous Norwegian dietary studies (Blaker & Aarsland, 1989). We also included questions about weight, height, physical activity, smoking habits, meal frequency and attitudes towards diet and body weight. Statistics Norway provided information about the subjects' level of education and several other demographic and geographical variables from their registers. The intake of nutrients from cod-liver oil, and vitamin and mineral supplements was not included in the calculations presented in the present paper. The following variables were included in our analysis.

Indicators for dietary habits. (a) Fruits and vegetables (fresh fruits and berries, orange juice and fresh, frozen and canned vegetables, excluding potatoes) and (b) fibre, both presented as g/10 MJ; (c) fat as a percentage of total energy intake (E %); (d) Hegsted score (mg/dl) providing an

estimate of the impact of dietary lipids on serum cholesterol (Hegsted *et al.* 1993). This was determined according to Hegsted's equation (serum cholesterol (mg/dl) = 2·1 saturated fatty acids (E %) − 1·16 polyunsaturated fatty acids (E %) + 0·067 cholesterol (mg/4184 kJ)).

Socio-demographic variables. Education was classified as short (< 13 years in school, upper secondary school or lower) or long (≥ 13 years in school, at least at college or university level) (Central Bureau of Statistics, 1989). Length of education (5–20 years) was also used as a continuous variable in the regression model. The participants were categorized into twelve socio-economic status groups according to official standards for classification (Central Bureau of Statistics, 1984). This classification uses a combination of several variables, such as having paid work or not; type of occupation; length and type of education; and authority. In the present analysis two aggregates of socio-economic status were used; blue-collar workers (unskilled and skilled workers, and lower level salaried employees) and white-collar workers (mean and higher level salaried employees). Income per year was split into tertiles separately for each sex. Location of residence was classified as rural (< 200 inhabitants), urban (200–99 999 inhabitants) or cities (≥ 100 000 inhabitants), based on Norwegian standards (Statistics Norway, 1994).

Lifestyle variables. Attention to healthy diet was categorized as very low, low, medium, high or very high (score 0–4) by the question: How much attention do you pay to keeping a healthy diet? Smoking habits were classified as non-smoking, smoking ≤10 or ≥11 cigarettes or pipes daily. Frequency of exercise was classified as < 1, 1–3 or ≥ 4 times/week by the question: How often do you have physical exercise for at least 20 min (walking, jogging, bicycling, swimming)?

Statistics

Data for men and women were analysed separately by the Statistical Package for the Social Sciences program (SPSS for Windows, release 7.5; SPSS Inc., Chicago, IL, USA). The *t* test and one-way ANOVA test with Bonferroni correction, were used to test differences in mean dietary intake between groups. In order to assess the relative contributions of the demographic, social and lifestyle variables to the variation of the four dietary indicators, a two-step multiple regression model was applied. First education and location of residence were introduced together, with age forced into the model. Then each of the lifestyle variables, degree of attention paid to keeping a healthy diet, smoking habits and exercise, was introduced separately into the model together with age, education and residence.

Results

Dietary intake according to sex and age

The absolute daily intakes of energy and fibre were higher among men than women, but women had a higher intake of fruits and vegetables (Table 1). When computing intake per 10 MJ, women had 53 % higher intake of fruits and vegetables, as compared with men. Furthermore, women had a higher intake of fibre, and a slightly lower percentage of dietary energy from fat than men. In both sexes the older age groups had a higher intake of fruits and vegetables and fibre per 10 MJ, as compared with the age groups 16–29 and 30–39 years (Tables 2 and 3). Individuals aged 30–39 years had the highest fat E %, and the age group 70–79 years had the highest Hegsted score, as compared with other age groups. This was seen among both men and women.

Diet indicators related to social status and lifestyle

Men and women with at least 13 years of education had higher intakes of fruits and vegetables and fibre, and lower fat E % and Hegsted score, than those with less than 13 years of education (Tables 2 and 3). Both male and female white-collar workers had higher intakes of fruits and vegetables and fibre than blue-collar workers. Female white-collar workers also had a lower fat E % than female blue-collar workers. Income showed an inconsistent association with dietary factors among men and women. Men, as well as women, living in cities had a higher intake of fruits and vegetables than those living in rural areas. Males living in cities also had lower fat E % and lower Hegsted score than

Table 1. Age and dietary characteristics of 1517 men and 1627 women selected as a representative random sample of the Norwegian population

(Mean values and standard deviations)

	Men		Women		Statistical significance of difference between means, P=*
	Mean	SD	Mean	SD	
Age (years)	42·9	16·3	42·0	16·9	0·10
Energy (MJ/d)	11·7	4·3	8·4	2·9	<0·001
Fruits and vegetables (g/d)	297	212	324	213	<0·001
Fruits and vegetables (g/10 MJ)	258	162	396	236	<0·001
Fibre (g/d)	26·1	10·2	20·8	8·1	<0·001
Fibre (g/10 MJ)	22·7	6·2	25·4	7·0	<0·001
Fat (% energy)	30·9	5·9	29·9	5·9	<0·001
Hegsted score (mg/dl)†	28·6	7·6	28·9	7·2	0·27

* Statistical analysis was by *t* test.
† Determined by the equation: serum cholesterol (mg/dl) = 2·1 saturated fatty acids (% energy) − 1·16 polyunsaturated fatty

Table 2. Dietary characteristics of a representative sample of Norwegian men subdivided by age and social factors (Mean values and standard deviations)

		Fruits and vegetables (g/10 MJ)		Fibre (g/10 MJ)		Fat (% energy)		Hegsted score ‡ (mg/dl)	
	n†	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Men, total sample	1517	257	163	22	6	31	6	29	8
Age (years)									
16–29	366	234	157	21	6	31	6	28	7
30–39	339	240	143	21	5	32*	5	28	7
40–49	302	271*	155	24*	5	31	6	27	7
50–59	232	274*	203	24*	7	30	6	29	8
60–69	163	279*	153	25*	6	30	6	30	8
70–79	115	289*	154	25*	7	31	6	33*	10
Education (years)									
Short (<13)	1139	250	159	22	6	31*	6	28*	9
Long (≥13)	307	282*	168	24*	6	30	6	27	7
Socio-economic status									
Blue-collar	404	225	159	21	6	31	6	28	7
White-collar	457	282*	164	23*	6	31	6	28	7
Income									
Low	469	246	169	22	6	31	6	30*	8
Medium	471	243	134	23*	6	31	5	29	7
High	463	278*	176	23	6	31	6	28	7
Location of residence									
Rural	336	239	171	23	6	31*	6	30*	8
Urban	810	253	152	23	6	31*	6	28	7
Cities	330	286*	176	23	6	30	6	28	8
Cigarettes (no./d)									
Non-smoker	926	269*	162	24*	6	30	6	28	7
≤10	324	252	166	22*	6	32*	6	29	7
≥11	267	226	154	21	6	32*	6	29	8
Exercise (times/week)									
<1	441	218	145	21	6	32*	6	30*	8
1-3	684	262*	153	23*	6	31*	6	28	7
4+	383	294*	185	24*	7	30	6	28	8
Attention to healthy diet									
Very low	56	199	124	19	5	34*	7	32*	11
Low	186	215	170	20	6	33*	6	29*	8
Medium	844	244	146	22*	6	31*	5	29*	7
High	342	305*	175	25*	6	30	6	27	7
Very high	86	334*	191	26*	8	29	7	28	9

Mean values were significantly different from the lowest value (or two lowest values where identical) within the column: *$P < 0.05$ (one-way ANOVA with Bonferroni correction or *t* test).
† Information about socio-demographic and lifestyle variables was missing for some subjects.
‡ Determined by the equation: serum cholesterol (mg/dl) = 2·1 saturated fatty acids (% energy) − 1·16 polyunsaturated fatty acids (% energy) + 0·067 cholesterol (mg/4184 kJ).

males living in rural areas. Non-smokers had higher intakes of fruits and vegetables and fibre, as well as lower fat E %, compared with smokers. Subjects exercising regularly had higher intakes of fruits and vegetables and fibre, and lower fat E % and Hegsted score than subjects exercising less than once weekly. Men and women paying high attention to a healthy diet had higher intakes of fruits and vegetables and fibre, as well as lower fat E %, compared with those paying low or medium attention to a healthy diet. The magnitude of the difference in the level of dietary indicators was greatest between subjects paying different degrees of attention to keeping a healthy diet. Men and women paying high and very high attention to keeping a healthy diet had higher intakes of fruits and vegetables (47–85 %) and fibre (32–33 %), and lower fat E % (14 %) and Hegsted score (10–11 %), compared with subjects paying low and very low attention to keeping a healthy diet.

Many of the socio-demographic and lifestyle variables were correlated. In both sexes the number of years in school was significantly higher among white-collar workers, subjects living in cities, non-smokers and subjects having regular exercise, as compared with subjects in other subgroups of socio-demographic and lifestyle variables. The number of years in school was also significantly higher among women who paid high and very high attention to a healthy diet, compared with those who paid very low to medium attention (10·6 *v.* 11·0 years; $P = 0.008$). This difference was not significant among men (11·1 *v.* 11·4 years; $P = 0.058$). Partial Pearson correlations controlled for age between length of education (5–20 years) and degree of attention paid to healthy diet (score 0–4) were 0·10 ($P < 0.001$) among men and 0·12 ($P < 0.001$) among women. Among men with short and long education periods the percentages paying high and very high attention to a

Table 3. Dietary characteristics of a representative sample of Norwegian women subdivided by age and social factors (Mean values and standard deviations)

		Fruits and vegetables (g/10 MJ)		Fibre (g/10 MJ)		Fat (% energy)		Hegsted score ‡ (mg/dl)	
	n†	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Women, total sample	1627	395	235	25	7	30	6	29	7
Age (years)									
16–29	479	347	214	23	6	30	6	27	6
30–39	332	352	199	24	6	31*	6	29	6
40–49	297	418*	240	26*	7	30*	6	29	7
50–59	214	461*	289	28*	8	30	6	29	8
60–69	174	457*	229	29*	6	28	6	30	9
70–79	131	445*	242	27*	7	30	6	32*	8
Education (years)									
Short (<13)	1224	381	229	25	7	30*	6	29*	7
Long (≥13)	316	448*	253	27*	7	29	6	28	6
Socio-economic status									
Blue-collar	370	365	228	24	7	31*	6	29	7
White-collar	459	412*	232	26*	7	29	6	28	6
Income									
Low	490	402	250	25	7	31	6	28	7
Medium	465	386	234	26	7	31	5	29*	7
High	471	395	224	25	7	31	6	29*	7
Location of residence									
Rural	328	369	208	25	7	30	6	30	7
Urban	931	394	237	25	7	30	6	29	7
Cities	321	427*	251	26	7	29	6	28	8
Cigarettes (no./d)									
Non-smoker	1040	410*	224	26*	7	29	6	29	7
≤10	358	383	258	25	7	30*	6	29	7
≥11	229	353	247	24	7	31*	6	29	8
Exercise (times/week)									
<1	367	344	231	23	6	31*	6	30*	7
1-3	818	397*	223	25*	7	30*	6	29	7
4+	429	435*	254	27*	8	29	6	29	7
Attention to healthy diet									
Very low	17	229	125	20	6	33*	8	31	10
Low	92	258	186	21	6	32*	6	31	8
Medium	884	362	203	24	6	31	6	29	7
High	515	451*	249	27*	7	28	5	28	7
Very high	115	548*	313	30*	9	28	7	28	8

Mean values were significantly different from the lowest value (or two lowest values where identical) within the column: *$P < 0.05$ (one-way ANOVA with Bonferroni correction or *t* test).
† Information about socio-demographic and lifestyle variables was missing for some subjects.
‡ Determined by the equation: serum cholesterol (mg/dl) = 2·1 saturated fatty acids (% energy) − 1·16 polyunsaturated fatty acids (% energy) + 0·067 cholesterol (mg/4184 kJ).

healthy diet were 26 % and 36 % respectively, and among women 35 % and 47 % respectively.

The intake of fruits and vegetables was higher among subjects with long compared with short education periods in all subgroups of attention paid to healthy diet (Fig. 1 (a and b)). However, degree of attention to healthy diet had a larger impact on the intake of fruits and vegetables than education. For example, this intake was higher among both men and women with short education and high attention to keeping a healthy diet, as compared with those with long education and medium attention to keeping a healthy diet.

The largest difference in dietary indicators was found between young men with short education, living in rural areas, paying low attention to keeping a healthy diet, and middle-aged women with long education, living in cities, paying high attention to keeping a healthy diet. This subgroup of women aged 30–59 years had 300 % higher intake of fruits and vegetables (132 *v.* 581 g/10 MJ) than the subgroup of men aged 16–29 years.

Multiple regression analysis

Age, education and location of residence together explained between 1 and 9 % of the variation (R^2) in the four dietary indicators, when introduced in the multiple regression model (Tables 4 and 5, step 1). In both sexes age was correlated to all four dietary indicators. Length of education was significantly associated with three of the four dietary indicators both among men and women. Residence in cities *v.* other areas was associated with higher intake of fruits and vegetables and lower intake of fat among men. Men living in rural areas had higher Hegsted score *v.* men living in other areas.

When the variable 'attention paid to keeping a healthy diet' was included in the regression model (step 2), R^2 increased substantially for all four dietary indicators in both sexes. Age remained correlated to the dietary indicators, except for fat intake, in both sexes. Length of education remained significantly correlated with three dietary indicators among women and one among men. The correlations between residence and dietary indicators found in the first step remained significant among men, even after 'attention paid to keeping a healthy diet' was introduced in the model.

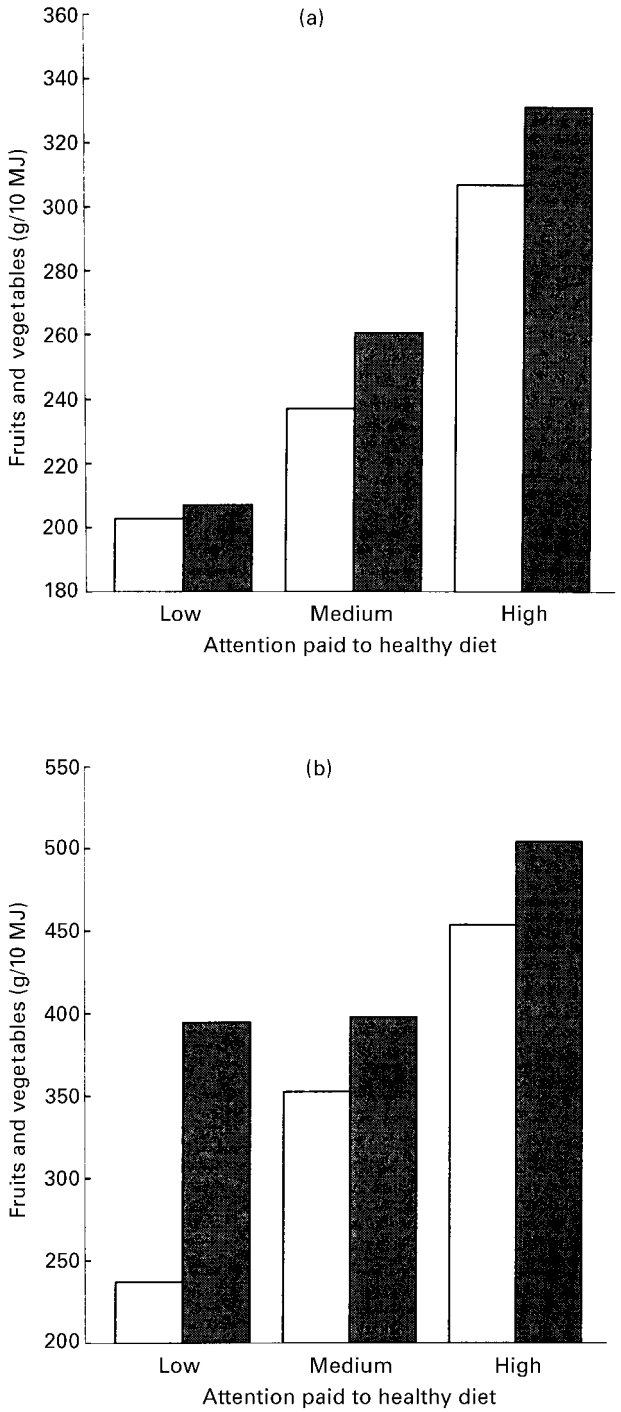

Fig. 1. Intake of fruits and vegetables (g/10 MJ) in relation to degree of attention paid to eating a healthy diet and level of education (□), < 13 years; (■), 13 + years) in (a) Norwegian men and (b) Norwegian women.

No significant interactions between length of education and degree of attention paid to keeping a healthy diet in relation to the variation of intake of the four dietary indicators were found. When we used education as a dichotomized variable (< 13 and ≥ 13 years of education) in the regression models, this had minor effects on the results. As education and socio-economic status were strongly associated, only education was used as an indicator for social status in the regression model.

When frequency of leisure time physical exercise (1–4+ *v.* <1 times/week) was introduced instead of 'attention paid to keeping a healthy diet' in the regression model, regular exercise was significantly correlated to all four dietary indictors in both sexes, in a similar way as has been shown for degree of attention paid to keeping a healthy diet (results not shown). R^2 increased substantially when physical exercise was included in step 2 of the model, but not as much as when 'attention paid to keeping a healthy diet' was introduced. When degree of attention paid to keeping a healthy diet was replaced by smoking habits (smokers *v.* non-smokers) in the second step of the regression model, R^2 increased only slightly for most of the dietary indicators (results not shown). Non-smoking was positively correlated to intake of fibre, and negatively correlated to fat E % among both men and women. Furthermore, non-smoking was also positively correlated with intake of fruits and vegetables and negatively correlated with Hegsted score among men.

Discussion

The present study, in common with several other studies, has shown that social status is correlated to indicators for healthy diet (Aarø, 1986; Prättälä *et al.* 1994). Thus, dietary differences may contribute to the lower mortality from chronic diseases observed among groups with high socio-economic status in Norway (Jacobsen & Thelle, 1988; Thürmer, 1993). However, social status was a weak predictor for healthy dietary habits in our survey, as well as in large surveys in the Netherlands, Australia and Finland (Hulshof *et al.* 1991; Smith & Baghurst, 1992; Roos *et al.* 1996). Of the indicators for social status in our analysis, education was the best determinant of healthy dietary habits. The variable that showed the strongest and most consistent association with all four indicators of healthy dietary habits in both sexes was degree of attention paid to keeping a healthy diet. This indicates that personal preference may be a more important determinant of healthy dietary habits than social determinants such as education, socio-economic status and location of residence. However, one must bear in mind that education and attention to healthy diet were correlated. Furthermore, we had only one single variable indicating dietary attitudes in our survey.

The validity of the reported dietary habits depends on the survey method. The method used in our study has been evaluated against 14 d weighed records (Nes *et al.* 1992), 48 h recall (Solvoll *et al.* 1993) and against the concentration of

Table 4. Multiple regression of indicators for dietary habits *v.* age, education, residence and attention to healthy diet in a representative sample of Norwegian men (*n* 1402)

(*β*-Coefficients with *P* values and adjusted R^2)

	Fruits and vegetables (g/10 MJ)		Fibre (g/10 MJ)		Fat (% energy)		Hegsted score (mg/dl)	
	β	*P*	*β*	*P*	*β*	*P*	*β*	*P*
Step 1								
Age (16–79 years)	1·4*	<0·001	0·12*	<0·001	–0·03*	<0·001	0·06*	<0·001
Education (5–20 years)	4·0*	0·018	0·17*	0·010	–0·10	0·104	–0·21*	0·011
Residence (rural *v.* other)	–11·0	0·310	0·32	0·423	0·28	0·483	1·4*	0·005
Residence (cities *v.* other)	24·8*	0·022	0·11	0·795	–1·1*	0·006	–0·22	0·673
Adjusted R^2 (%)	2·5		8·5		1·4		2·9	
Step 2								
Age (16–79 years)	0·7*	0·002	0·09*	<0·001	–0·02	0·098	0·08*	<0·001
Education (5–20 years)	3·0	0·073	0·12	0·065	–0·06	0·289	–0·17*	0·033
Residence (rural *v.* other)	–4·5	0·671	0·64	0·099	0·05	0·903	1·2*	0·018
Residence (cities *v.* other)	22·3*	0·036	–0·02	0·962	–1·0*	0·010	–0·13	0·797
Attention to healthy diet (0–4)	40·3*	<0·001	2·0*	<0·001	–1·4*	<0·001	1·4*	<0·001
Adjusted R^2 (%)	6·4		15·0		5·3		4·9	

* Statistically significant at $P < 0·05$.

very-long-chain *n*-3 fatty acids in plasma phospholipids (Frost Andersen *et al.* 1996). These studies showed that the questionnaire could be used for assessing intakes of a wide range of nutrients. Furthermore, results such as those reported in this paper may reflect systematic over-reporting of healthy habits among those paying particular attention to their diet. However, the fact that underreporting of energy intake did not differ systematically between subgroups with different degrees of attention paid to keeping a healthy diet can be taken as an indication of the validity of the findings (Johansson *et al.* 1998).

The external validity, i.e. the potential to generalize the observations, depends on the distribution of the responders with regard to social and demographic background. A skewed socio-demographic distribution of responders or a large drop-out of subjects with unhealthy dietary habits, may reduce the chance of revealing differences within the population. However, the present distribution of subjects with different socio-economic status, location of residence and length of education, was similar among the responders in our survey and the general population (Statistics Norway, 1995), and there were only small differences between

Table 5. Multiple regression of indicators for dietary habits *v.* age, education, residence and attention to healthy diet in a representative sample of Norwegian women (*n* 1492)

(*β*-Coefficients with *P* values and adjusted R^2)

	Fruits and vegetables (g/10 MJ)		Fibre (g/10 MJ)		Fat (% energy)		Hegsted score (mg/dl)	
	β	*P*	*β*	*P*	*β*	*P*	*β*	*P*
Step 1								
Age (16–79 years)	3·1*	<0·001	0·13*	<0·001	–0·02*	0·010	0·06*	<0·001
Education (5–20 years)	12·9*	<0·001	0·43*	<0·001	–0·24*	<0·001	–0·14	0·079
Residence (rural *v.* other)	–18·8	0·213	0·02	0·956	–0·17	0·665	0·14	0·759
Residence (cities *v.* other)	29·4	0·056	0·23	0·614	–0·76	0·056	–0·58	0·219
Adjusted R^2 (%)	5·5		9·4		1·1		2·4	
Step 2								
Age (16–79 years)	2·2*	<0·001	0·10*	<0·001	–0·005	0·606	0·07*	<0·001
Education (5–20 years)	10·2*	<0·001	0·34*	<0·001	–0·18*	0·007	–0·10	0·229
Residence (rural *v.* other)	–17·7	0·228	0·06	0·890	–0·19	0·615	0·12	0·788
Residence (cities *v.* other)	25·1	0·094	0·09	0·840	–0·66	0·088	–0·50	0·280
Attention to healthy diet (0–4)	73·4*	<0·001	2·3*	<0·001	–1·60*	<0·001	–1·2*	<0·001
Adjusted R^2 (%)	10·3		15·0		4·7		3·8	

* Statistically significant at $P < 0·05$.

responders and the total sample regarding age, sex, geographical distribution and educational level (Johansson *et al.* 1997*a*). Other surveys indicate that health-conscious subjects are more willing to participate in dietary surveys (Jörgensen, 1992; Osler & Scroll, 1992), and that selective drop out may lead to underestimation of the real differences related to social status in the population (Turrel & Najman, 1995). However, we have no way of assessing whether our responders had healthier habits than non-responders.

In the present survey age was associated with all four indicators for healthy diet in both sexes. Women reported a healthier diet than men. Dietary differences between Norwegian men and women have previously been reported in dietary surveys among selected groups (Blaker *et al.* 1988) and in surveys using food-frequency or qualitative questionnaires in large samples (Solvoll *et al.* 1989; Wandel, 1995), as well as in surveys in other industrialized countries (Subar *et al.* 1992; Kleemola *et al.* 1994). Non-smokers of both sexes reported a higher intake of fibre, and lower fat E% than smokers. A less healthy diet among smokers compared with non-smokers has also been reported in other studies (Margetts & Jackson, 1993; Jarvinen *et al.* 1994; Trygg *et al.* 1995).

The Norwegian diet has become lower in fat, the fatty acid pattern has improved and the consumption of fruits and vegetables has increased during the last 20 years (National Nutrition Council, 1996). When compared with previously performed dietary surveys (Johansson *et al.* 1996) the present survey indicated that all groups of the population have changed towards a lower-fat diet. However, dietary differences related to sex, social status and location of residence still exist. This pattern fits with the hypothesis that dietary changes diffuse from high social status groups and urban areas to other parts of society (Rogers, 1995). Thus, we may expect a delay between groups of different social status regarding healthy food choices. For example, traditionally the Norwegian diet was lower in fat in rural areas as compared with cities, but during the last 20 years the dietary lipid pattern (Johansson *et al.* 1996), as well as the mortality from CHD have improved more in urban than in rural areas (Westlund, 1971; Krüger *et al.* 1995). In our present study, men living in rural districts had higher Hegsted scores and lower intakes of fruits and vegetables, than men living in cities. Furthermore, the Hegsted score was on average 5 mg/dl lower in the youngest compared with the oldest age group, corresponding to a 2% difference in serum cholesterol (Bjartveit *et al.* 1991) and a 6–10% difference in the risk of CHD (Law *et al.* 1994). It is difficult to tell what has caused the observed dietary changes, but they coincide with two decades of follow-up of the Norwegian Food and Nutrition Policy (Ministry of Health and Social Affairs, 1992). The present analysis suggests that dietary habits are associated with social status, but also that personal preferences may be very important independent of social status. This may have been promoted by systematic nutrition education.

In conclusion, we found that healthy diet was associated with social status and other lifestyle habits. As the official health promotion policy aims at improving health for everybody and decreasing health differences within the population, it is important to strengthen nutrition education in the general population and in particular among low social status groups with high incidence of non-infectious chronic diseases.

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