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Educational differences in the diet of Finnish adults and the associations between education and the determinants and facilitators of dietary fat quality

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Abstract

Objective: The aim of the study is to elucidate differences in adults' diet by education, and to analyse the associations between dietary facilitators, education and dietary fat quality.
Design: In all, one-third of subjects from the national FINRISK health survey were invited to participate in the FINDIET 2007 Survey. A 48 h dietary interview was used for dietary data and personal background data were collected by the health survey questionnaire.
Setting: Representative sample from five regions in Finland in spring 2007.
Subjects: A total of 1576 adults, participation rate 60 %.
Results: Oil used in cooking differed by education. Instead perception of cardiovascular risk, or the following of a cholesterol-lowering diet, were equal across all educational categories. The diet of men with low education contained less protein and carbohydrates, more fat and more SFA and MUFA than that of highly educated men. The diet of women with low education contained less PUFA, vitamin C and vitamin E than in the highly educated category. High education remained a significant determinant for the lower intake of SFA in men, and for the higher intake of PUFA in women, after adjusting for the determinants and facilitators of dietary behaviour and age. The lower intake of SFA was also associated with following a cholesterol-lowering diet in both genders. In addition to education, the intake of unsaturated fatty acids was determined by the oil used in cooking by women, and by frequent lunches served by caterers for men.
Conclusions: In dietary behaviour, awareness and reporting of cholesterol-lowering diet seem to indicate a tendency to control the intake of saturated fat. Health messages are likely to enhance tools for increasing the intake of PUFA, in addition to reducing the intake of SFA.

Keywords
Diet
Education
Fat quality
Food consumption
Nutrient intake

Health status and health behaviour of the Finnish population differ by educational category[1,2]. Health behaviour, including food habits, is the basis for decreasing the risk of chronic diseases[1,3]. The dietary intake of SFA has been the main dietary factor associated with cardiovascular (CV) mortality in Finland[4]. From dietary changes, the increasing consumption of vegetable oil and oil-based spreads is assumed to explain the decreasing levels of serum cholesterol[5] and the decline in cardiovascular mortality[4]. Serum total cholesterol has decreased in Finnish adults of all educational categories in the last decades[6]. However, more than half of the adult population in Finland still has a high serum cholesterol, >5 mmol/l[5,7]. Therefore, the main message in treating hypercholesterolemia as well as for general population is to decrease the intake of SFA and increase the intake of PUFA[8–10].

According to the Finnish Health Behaviour Surveys[1,11], the daily consumption of vegetables, selection of fat-free milk and oil-based spreads on bread are more common for highly educated persons. The consumption of fresh vegetables, fruit, fruit juice, whole-grain bread and cheese is more frequent among higher socio-economic groups in all European countries[12–17]. In several ways, food choices better comply with dietary guidelines in higher-level socio-economic groups than in lower-level groups[11,12,18,19]. However, following dietary advice to change levels of dietary fat or fat quality has been reported as difficult even for motivated persons[20] as well as for patients with CHD[10].

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In Finland, there is still the need to change the quality of dietary fat by decreasing the intake of SFA and increasing the intake of PUFA according to the present FINDIET survey[21]. For actions in clinical practice in the prevention of CVD, it is important to find tools that help to control the intake of saturated fat and promote healthy food choices[10,22–24]. Such tools and facilitators include availability of healthy food, healthy food at canteens, experiences and knowledge with food or increasing skills in cooking[10,20,25,26]. In the present study, we analyse the differences in diet by level of education and further test the association between educational category, determinants and facilitators of dietary behaviour, and dietary fat quality.

Materials and methods

The cross-sectional population survey FINRISK 2007 was carried out in order to assess the risk factors of CVD[27]. A random sample of adults aged 25–74 years, stratified by sex, region and 10-year age groups, was drawn from the population register for six regions in Finland. Subjects were invited to a health examination including body weight measurement and blood sample at the local health-care centre. The invitation included a questionnaire to be completed, covering such background information as social status, health status, habitual food choices and perceptions of CV risk. From five regions of the FINRISK study, subjects in a subsample (33 %) were asked to participate in a 48 h dietary interview[28]. Of the 25–64-year-old invited subjects, 60 % participated in the dietary interview of FINDIET 2007.

Education years were categorized in tertiles (low, middle and high) according to gender and birth year. The regions were aggregated as Southern Finland (the capital region of Helsinki and Turku with its surroundings) and Northern Finland (North-Karelia, Northern Savo and Oulu region). Self-rated health status, self-rated functional capacity and serum cholesterol measurement were selected as health parameters. Serum cholesterol was measured by standard enzymatic protocol[7] from fresh blood samples. The questions for health status and functional capacity offered five alternatives, ranging from 'very good' to 'very bad'. Those giving either the answer 'rather bad' or 'very bad' were considered to have bad health or bad functional capacity. From perceptions of disease risks, the self-rated risk assessment for CVD was used. Self-rated risk assessment for CVD was based on five alternatives, ranging from 'very high' to 'very low', or 'I have a CVD'. Those answering with either of the two highest options or having a CVD were coded as having a high CV risk.

Questions concerning the determinants and facilitators of dietary behaviour were available from the background questionnaire and covered 'following a cholesterol-lowering diet', 'received dietary guidance after previous cholesterol measurement', 'frequent use of ready-to-eat meals', 'having daily lunch at a cafeteria or restaurant' and 'vegetable oil used in food preparation at home'. Dietary guidance after a previous serum cholesterol measurement was ascertained by a 'yes' or 'no' answer. If no previous measurement for serum cholesterol was reported, dietary guidance was coded 'no'. The question for following a cholesterol-lowering diet was answered 'no' or 'yes'. Those having more than two weekly ready-to-eat meals from supermarkets were coded as frequent users of these types of meal. The question of regular site lunch habits on working days gave six alternatives: 'no regular lunch', 'packed lunch', 'home', 'at a restaurant or bar', 'at a worksite cafeteria' or 'elsewhere'. Those having regular lunches at a worksite cafeteria, restaurant or bar were coded as frequently having catered lunches. The type of typical cooking fat used at home was identified with the options 'oil', 'high-fat spread', 'cooking margarine', 'butter-oil mixture', 'butter', 'sterol margarine', 'no fat', 'no cooking at home', from which those preferring oil were coded separately from the others.

Dietary data collection

Details of the dietary interview in FINDIET 2007 have been already published[21,28,29]. The interview covered the diet of participants over the 48 h before interview. It began by asking about meals eaten yesterday and continued by enquiring into meals taken on the day before yesterday. Identification of each eating event was principally based on the name of the eating occasion which was given to it by the subject. The interviewer selected the meal name from the following alternatives: breakfast, lunch, dinner, drink, evening snack, other snack and other eating event.

Daily aggregated food consumption and nutrient intake were calculated by in-house software that uses the Finnish food composition database[30]. The dietary data were converted to food consumption in seventy-six food groups[21] from which eighteen food groups were chosen and aggregated for the analyses of the present study. For food consumption, and energy and nutrient intake, the mean intake over 2 d was calculated. Nutrient intake is expressed either as an energy percentage or intake per unit of energy (MJ).

Statistical methods

The associations between background variables and education were tested by χ^2 test. The differences in nutrient intake between education categories were tested by ANOVA. Education was inserted into the model, first as a categorical variable and then as a continuous variable (trend test). For these analyses, the nutrient intake was converted into a logarithmic scale in order to improve normality.

The differences in food consumption between education categories were analysed with Kruskal–Wallis nonparametric test, since the food consumption variables

were not normally distributed. These analyses were performed with consumption calculated in relation to energy intake (MJ). The associations between the determinants and facilitators of dietary behaviour and the intakes of SFA and PUFA were tested by ANOVA. The explanatory variables were included in the model in three ways: each background variable individually, all variables in the full model and finally, only the significant variables in the final model. All the models were adjusted in relation to age.

All the analyses were performed by using the SAS for Windows statistical software package version 8·2 (SAS Institute Inc., Cary, NC, USA). All analyses were performed separately for men and women, because there are differences by gender in socio-economic status and food behaviour.

Results

Daily dietary habits differed by educational category. Both women and men in the high-educational category had more frequent lunches at worksite cafeterias or in restaurants, and more often used oil in food preparation than others (Table 1). In women, use of ready-to-eat meals was most frequent in the high-educational category. By contrast, perception of a high CV risk, receiving dietary advice after previous cholesterol measurement, or following a cholesterol-lowering diet showed no difference by education. Basic health status was rated as poor by 11 % in the low-educational category of women and by 4 % in the high-education category and by 15 % and 4 % in men, respectively (Table 1). Similar trends were observed in functional capacity in women.

Educational category was associated with some differences in nutrient intakes in men and in women (Table 2). In the low-educational category, the diet of men contained less protein and carbohydrates, more fat and more SFA and MUFA than in higher-educational categories. In addition, the folate intake was smaller in the low-educational category than in the high category in men (Table 2). In women, the intakes of PUFA, vitamin C, vitamin E and folate increased in the higher-educational category.

The diet of adults differed in vegetable and fruit consumption and the lowest consumption was observed in the low-educational category of both men and women. Adults with low education more frequently used medium-fat milk than those with higher education in both genders. The consumption of fat-free milk was higher with higher education only in men. The daily consumption of margarines that contained at least 60 % fat and were used as spreads was higher in the low-educational categories of both genders (Table 3). Use of other spreads, butter or low-fat spreads, were not significantly associated with education. The consumption of oil dressing was lowest in women with low education. Furthermore, sausage consumption was more typical in the low-educational category and fish consumption in the high-educational category in women.

The association between the determinants and facilitators in dietary habits, education and the intakes of SFA and PUFA were studied by single and multiple regression analysis. In single ANOVA, education was a significant determinant for the intake of SFA in men, but not in women (Table 4). Both men and women following a cholesterol-lowering diet and reporting use of oil as cooking fat had lower intake of SFA compared to the others. Further, in women, frequent consumption of ready-to-eat meals was associated with higher intake of SFA. In men, having received previous dietary guidelines for lowering cholesterol was associated with the intake of SFA (Table 4), and a frequent habit of eating served

Table 1 Basic characteristics of dietary behaviour and health status in the adults of FINDIET 2007 by education

	Educational category					
	Women			Men		
	Low (*n* 272)	Middle (*n* 275)	High (*n* 294)	Low (*n* 240)	Middle (*n* 255)	High (*n* 230)
	%	%	%	%	%	%
Determinants and facilitators of dietary behaviour						
High self-rated cardiovascular risk	18	22	18	17	18	14
Following a cholesterol-lowering diet	9	10	9	8	12	10
Previous dietary guidance	37	42	42	53	50	54
Frequent lunches by caterers*,†	22	28	34	23	34	51
Oil used in cooking at home*,†	45	53	69	43	44	55
Ready-to-eat meals frequently*	11	17	18	16	19	17
Health status						
Poor self-rated health*,†	11	4	4	15	12	4
Poor functional capacity*	16	11	9	15	14	10
	Mean	SD	Mean	SD	Mean	SD
Serum cholesterol	5·1	5·2	5·1	5·3	5·3	5·2
Serum cholesterol	0·9	1·0	0·0	1·1	1·0	1·0

*$P < 0{\cdot}05$ for differences in frequencies by education in χ^2 test in women.
†$P < 0{\cdot}05$ for differences in frequencies by education in χ^2 test in men.

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Table 2 Nutrient intake (E % or per MJ energy intake) by education in FINDIET 2007

	Educational category												
	Women							Men					
	Low (*n* 272)		Middle (*n* 275)		High (*n* 294)			Low (*n* 240)		Middle (*n* 255)		High (*n* 230)		
Nutrient	Mean	SD	Mean	SD	Mean	SD	*P* for trend	Mean	SD	Mean	SD	Mean	SD	*P* for trend
Energy (MJ)	6·6	2·1	6·6	1·8	7·1	2·1	0·001	9·4	2·9	9·4	2·9	8·9	2·7	
Energy (kcal)	1575	492	1587	439	1692	510		2236	703	2245	697	2123	637	
Protein (E%)	17·0	4·3	17·0	3·6	17·0	4·2		16·0	3·4	17	3·9	17	3·6	0·01
Fat (E%)	31·0	7·7	31·0	7·2	32·0	7·3		35·0	7·9	32	7·8	32·0	7·5	0·001
SFA (E%)	12·3	4·2	11·9	3·8	11·9	3·8		13·9	4·4	12·5	3·9	12·2	3·9	0·001
MUFA (E%)	10·8	3·3	10·8	3·1	11·1	3·2		12·7	3·6	11·8	3·5	11·6	3·3	0·001
PUFA (E%)	5·3	1·9	5·7	2·1	6·0	2·4	0·002	6·0	2·2	5·8	2·2	5·8	2·2	
Carbohydrates (E%)	51·0	8·0	51	8·0	50·0	8·0		46·0	9·0	48·0	9·0	48·0	9·0	0·02
Sucrose (E%)	10·6	5·8	10·5	4·8	10·4	4·6		10·0	6·6	9·7	5·8	9·4	5·3	
Alcohol (E%)	1·1	4·3	1·3	3·3	1·5	3·6	0·01	2·8	6·0	3·0	6·2	3·3	6·7	
Fibre (g/MJ)	3·1	1·3	3·2	1·2	3·2	1·3		2·5	1·1	2·8	1·2	2·7	1·1	
Vitamin C (mg/MJ)	17·0	12·0	19	13·0	20	13	0·001	9·0	9·0	12·0	10·0	12·0	10·0	
Vitamin E (mg/MJ)	1·1	0·4·0	1·2	0·4	1·3	0·5	0·001	1·1	0·4	1·1	0·4·0	1·1	0·4	
Folate (μg/MJ)	33·5	15·0	34·9	13·0	35·1	13·0	0·05	27·9	10·0	29·8	11·0	32·0	15·0	0·001

E%, energy percentage.

Table 3 Food use for selected food groups (g/d) by educational category in women and men in FINDIET 2007

	Educational category												
	Women							Men					
	Low (*n* 272)		Middle (*n* 275)		High (*n* 294)			Low (*n* 240)		Middle (*n* 255)		High (*n* 230)		
Food group	Mean	SD	Mean	SD	Mean	SD	*P* for trend*	Mean	SD	Mean	SD	Mean	SD	*P* for trend*
Vegetable (fresh, cooked)	134	125	161	136	187	150	<0·001	100	107	117	119	132	126	<0·001
Fruit (including dishes)	129	132	149	157	175	158	0·007	85	159	128	184	123	190	<0·001
Berries	48	82	55	85	52	90		30	69	48	93	42	85	0·018
Dark bread	100	59	97	61	98	62		147	98	156	110	128	75	
Bakery	75	78	78	84	72	77		101	117	96	115	113	112	0·013
Porridge	77	107	76	110	71	111		58	111	91	149	81	127	0·038
Potatoes	63	65	56	63	54	63	0·049	98	97	93	87	81	80	
Butter spreads	5	12	4	9	4	8		10	23	7	17	6	13	
Margarines (≥60 % fat)	6	12	4	9	3	7	0·042	13	22	10	22	5	10	0·024
Low-fat spreads	7	12	7	11	7	15		9	20	11	22	9	15	
Oil dressing	2	6	4	8	4	9	<0·001	4	13	3	9	6	12	<0·001
Milk fat-free	113	189	126	199	108	180		100	228	158	299	150	264	0·002
Milk medium fat	113	189	66	136	58	117	<0·001	206	291	171	297	110	209	<0·001
Cheese	26	29	28	31	34	38	0·043	34	46	34	41	34	34	
Meat dishes	134	118	130	111	127	115		184	147	197	158	176	140	
Sausages	33	41	25	31	19	30	<0·001	67	74	56	63	46	56	0·040
Fish dishes	28	63	40	65	42	67	<0·001	41	86	49	103	40	71	
Sweet and chocolate	17	29	16	26	19	31		12	30	11	26	14	28	

*Differences between educational categories were tested with non-parametric Kruskall–Wallis test for food consumption per 1 MJ energy intake.

lunches was associated with higher intake of PUFA (Table 5). Oil used in cooking at home was significantly associated with the increasing intake of PUFA in women.

In the final multiple regression model, only significant background factors and age were included (Tables 4 and 5). The high-educational category was associated with a lower intake of SFA in men and a higher intake of PUFA in women. Following a cholesterol-lowering diet was associated with a lower intake of SFA in both genders in the final model, and in women, who used oil in cooking at home. The final model accounted for 5·7 % of the variance in the intake of SFA in women and 5·0 % of the variance in men. The final multiple model for the determinants of the intakes of PUFA was significant only for women.

Discussion

Some dietary behaviours and determinants were influencing the intakes of SFA and PUFA in Finnish adults. Preventive cardiology aims to change the quality of dietary fat in at-risk-populations as well as across the entire population[6,8,10]. We wanted to explore the determinants and facilitators of dietary fat quality in this cross-sectional population survey. A favourable trend by increasing education was observed for the decreasing

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Table 4 The associations of educational category and facilitators of dietary behaviour with the intakes of SFA

	Single variables in model*		Full model*		Final model*	
	Women	Men	Women	Men	Women†	Men‡
Education						
Low	0·3333	1·7148	−0·0209	1·4143		1·6573
Middle	−0·0760	0·2514	−0·2476	−0·0504		0·2201
High (reference)	–	–	–	–		–
P value	NS	<0·001	NS	<0·001		<0·001
Cholesterol-lowering diet						
No diet	1·6619	1·6824	1·4403	1·4323	1·5187	1·6570
Following diet (reference)	–	–	–	–	–	–
P value	<0·001	0·001	0·005	0·009	0·001	0·001
Previous dietary guidance						
Not received	0·5370	0·7692	0·2746	0·5371		
Received (reference)	–	–	–	–		
P value	0·082	0·018	NS	NS		
Lunches served by caterers						
Frequently	0·0388	0·6009	0·1412	0·2667		
Rarely (reference)	–	–	–	–		
P value	NS	0·065	NS	NS		
Cooking fat at home						
Hard fat	1·5421	0·8278	1·4903	0·5144	1·4938	
Oil (reference)	–	–	–	–	–	
P value	<0·001	0·007	<0·001	NS	<0·001	
Ready-to-eat meals						
Frequently	0·7983	−0·0640	0·7818	−0·2266		
Rarely (reference)	–	–	–	–		
P value	0·035	NS	0·043	NS		
Cardiovascular risk						
Perceived high	−0·0049	0·2905	0·2821	0·4515		
Perceived low (reference)	–	–	–	–		
P value	NS	NS	NS	NS		

*Adjusted for age.
†$R^2 = 0·058$, $F = 3·816$; $P < 0·001$.
‡ $R^2 = 0·050$, $F = 6,699$; $P < 0·001$.

intake of SFA in men and for the increasing intake of PUFA in women, corresponding to earlier results[12,13,16]. Our results showed that certain dietary behaviours were associated with dietary fat quality in the multiple model in which all significant background variables were included. Following a cholesterol-lowering diet was associated with a decreasing intake of SFA both in women and men, which is an encouraging results for practices with limited time in primary health care[24]. However, in order to change the fat quality of the diet, an increased average intake of PUFA is needed. It seems obvious that the consumption of oil and margarines has not been fully adopted.

The possible determinants and facilitators of dietary behaviour such as selection of cooking fat, frequency of eating served lunches or ready-to-eat meals varied by education, whereas following a cholesterol-lowering diet did not. The background data of the present study included only limited facilitators by which subjects could have aimed to decrease their serum cholesterol category by personal dietary changes compared with previous studies[10,26]. However, a more systematic list of facilitators has revealed only weak associations with dietary fat quality[10] although change-motivation has affected the total fat intake[20]. By contrast, worksite cafeterias[18] and school canteens[26] have been reported to be good facilitators for healthy eating.

The serum cholesterol level did not differ by education in the subjects of FINDIET 2007. However, the mean cholesterol was above the recommended level in all groups and thus the recommendation for decreasing the intake of saturated fat is applicable for the majority of the population[9]. A limitation of the present study is the higher non-participation of subjects with lower education and younger age groups, which may have affected the results of cholesterol levels.

According to the present results, women in all educational categories have the same intake of total fat and SFA, but intake of PUFA was higher with higher education. By contrast, the intake of SFA was significantly higher in men with low education compared to men with higher education. One way of changing the fat content of diets towards more unsaturated fats is the use of oil in food preparation and salad dressings, which seems to be applied by highly educated people, but which still needs to be adopted by less-educated women. However, the selection of low-fat spreads is even in educational groups, and it may not be a tool to increase the intake of PUFA.

Most differences in food use and nutrient intake by education corresponded to previous studies[12,13,16,17,31]. The higher consumption of cheese in the high-educational category compensates for the higher consumption of medium-fat milk in the low-educational category, and

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Table 5 The association of educational category and facilitators of dietary change with the intakes of PUFA

	Single variables in model*		Full model*		Final model*	
	Women	Men	Women	Men	Women†	Men‡
Education						
Low	−0·6512	0·1734	−0·5909	0·3143	−0·5832	
Middle	−0·3014	−0·0305	−0·2896	0·0687	−0·2336	
High (reference)	–	–	–	–	–	
P value	<0·001	NS	0·002	NS	0·002	
Cholesterol-lowering diet						
No diet	−0·3221	−0·4815	−0·2846	−0·5122		
Following diet (reference)	–	–	–	–		
P value	NS	0·086	NS	0·093		
Previous dietary guidance						
Not received	−0·1333	−0·001	−0·0250	0·1545		
Received (reference)	–	–	–	–		
P value	NS	NS	NS	NS		
Lunches served by caterers						
Frequently	0·0124	0·3939	0·1629	0·4067		0·3939
Rarely (reference)	–	–	–	–		–
P value	NS	0·025	NS	0·030		0·025
Cooking fat at home						
Hard fat	−0·3994	−0·3038	−0·2846	−0·2600	−0·2999	
Oil (reference)	–	–	–	–	–	
P value	0·008	0·063	0·075	NS	0·0049	
Ready-to-eat meals						
Frequently	−0·0908	0·0027	−0·1047	0·0535		
Rarely (reference)	–	–	–	–		
P value	NS	NS	NS	NS		
Cardiovascular risk						
Perceived high	0·0387	0·1310	0·0422	0·1502		
Perceived low (reference)	–	–	–	–		
P value	NS	NS	NS	NS		

*Adjusted for age.
†$R^2 = 0·021$, $F = 6·831$; $P = 0·007$.
‡$R^2 = 0·011$, $F = 4·704$; $P = 0·089$.

results in a similar intake of SFA in women. In addition, the use of ready-to-eat meals was more frequent in highly educated women. This could be interpreted to suggest that a frequent consumption of ready-to-eat meals is associated with a diet of less-controlled fat quality[19]. Some differences in nutrient intakes by education were clear, e.g. for vitamin C intake in women, but the mean intake was, however, above the recommended level in all educational groups.

Food preparation skills have been reported as being associated with healthy eating in earlier studies[16,22,23]. Our results supported these findings with the association between dietary fat quality and cooking fat used at home, but this association was found in women only. It has been postulated that the population may benefit more from messages that emphasize fat quality rather than from messages that focus on fat quantity[32]. The quantity of fat and type of fat are the main themes in counselling sessions that have a mean duration of 5 min in counselling sessions with nurses, or 3 min in counselling sessions with physicians[24]. It is possible that women can achieve a better implementation of recommendations from a few words with the counsellor than men. On the contrary, the frequent consumption of lunches served through catering was associated with the intake of PUFA in men. This may be due to oil and oil dressing used in vegetable salads in restaurant or worksite cafeterias more than the type of cooking fat used by catering service. This may also be associated with the fact that in an interview concerning previous days, the subject is not able to give information on the cooking fat used by the caterer. The meals served by catering departments seem to have a desirable effect on the dietary fat quality in men[12]. In the present study, we could not study any actual changes in the dietary contributors of SFA, because the changes after dietary advice were not assessed.

Dietary counselling in primary health care also includes type of spread on bread[24]. However, the effect of spreads on the total intake of SFA has been decreasing due to the high proportion of low-fat spreads. In line with this, the only significant difference in the consumption of fat spreads was the higher consumption of margarines containing at least 60 % fat in the low-educational category. The identification of cooking fat was used in the present study as an index of dietary fat selection that supported the results of a previous study[16].

In conclusion, the fat quality of diets is still dependent on educational category. Food choices such as type of milk and fat used in cooking partly explain the differences in the fat quality of diets. In addition to education,

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following a cholesterol-lowering diet was associated with decreased intake of SFA in men, and oil used in cooking at home with increased intake of PUFA in women. These associations may be due to general health messages or achievements by health professionals. The results indicate that personal intentions in the control of dietary fat quality are worth further study. Finally, the national nutritional recommendations[9] favouring visible vegetable-based fat and oil, and avoiding hard fat hiding in mixed foods, are relevant.

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