

Nutrient intake by duration of ex-smoking in the Scottish Heart Health Study

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Information on current-, never- and ex-smokers (including duration of cessation) was obtained in a cross-sectional survey of risk factors for coronary heart disease (CHD), the Scottish Heart Health Study. Diet was also assessed by food frequency questionnaire in a total of 4265 men and 4770 women. Nutrient intakes were computed by sex and smoking group and, according to their diet, the ex-smokers were categorized as current- or never-smokers using discriminant analysis techniques.

The current- and five ex-smoking groups differed negligibly in past smoking characteristics. Energy-adjusted intake of polyunsaturated fat, fibre and the antioxidant vitamins were lowest in current-smokers, and for men, intakes increased progressively with duration of ex-smoking to reach the level of never-smokers. In a similar manner, energy, sugar and alcohol decreased with duration of ex-smoking. Fewer trends were observable for women, and the diets of ex-smokers more immediately resembled that of never-smokers.

Discriminant analysis for the combined nutrients correctly categorized 72 and 69% of male, and 66 and 65% of female current- and never-smokers respectively. By 4 years of smoking cessation the general dietary pattern of ex-smokers was similar to never-smokers for both sexes. Whether this represents a change in diet over time or a cohort effect is unclear, but the results do suggest that the apparent healthier diet of ex-smokers may contribute to their reduction in CHD risk compared with life-long current-smokers.

Antioxidant vitamins: CHD risk: Discriminant analysis: Ex-smokers: Nutrient intake

Smoking is recognized as one of the major risk factors for coronary heart disease (CHD), lung cancer and other respiratory diseases (US Office on Smoking and Health, 1979). Diet may also influence incidence of CHD by modulating blood cholesterol levels (e.g. saturated fat, fibre and cholesterol; Gurr *et al.* 1989; Bolton-Smith *et al.* 1991*a*) and by reducing free-radical-mediated tissue damage (the antioxidant vitamins A, C and E; Duthie *et al.* 1989; Gey *et al.* 1991).

The increased risk of CHD from smoking has been variously reported to be negligible in ex-smokers (Doll *et al.* 1980; Willett *et al.* 1987; Gramenzi *et al.* 1989); to be mitigated within 2–3 years (Rosenberg *et al.* 1985, 1990), within 5 years (Doll & Peto, 1976), or more generally within 10 years of cessation, in all but life-long heavy smokers (US Office on Smoking and Health, 1983). Some information is available on the changes in other risk factors which may occur on cessation of smoking from longitudinal and cross-sectional studies (Gordon *et al.* 1975; Kato *et al.* 1989). However, generally the literature addresses the socio-environmental and demographic characteristics of people who quit *v.* people who continue smoking, with little information on the effect of duration of quitting (West *et al.* 1977; Friedman *et al.* 1979; Ockene *et al.* 1985; Kaprio & Koshenvuo, 1988).

Diet may be one of the risk factors which alters with smoking cessation, for smoking

affects taste preferences (e.g. Grunberg, 1982) and quitters tend to have an improved health consciousness (West *et al.* 1977). Although numerous studies have examined the diets of current- and never-smokers (Whichelow *et al.* 1980; Fisher & Gordon, 1985; Fulton *et al.* 1988; Klesges *et al.* 1990) and some have included ex-smokers as a separate group (Fehily *et al.* 1984; Hebert & Kabat, 1990; Bolton-Smith *et al.* 1991c), it appears that Lincoln (1969) and Kato *et al.* (1989) are the only people to have previously reported dietary habits according to duration of ex-smoking.

Prospective studies of smoking and ex-smokers have problems with classification and recidivism (Rosenberg *et al.* 1990) and intervention studies have problems with success rate, classification and deception, e.g. the Multiple Risk-Factor Intervention Trial (MRFIT; Jarvis *et al.* 1984). Although cross-sectional studies are also far from ideal for looking at trends in ex-smokers (for group differences may be cohort effects rather than the effects of smoking *per se*), this type of data is more easily available. So long as group characteristics are compared and provisos made, the information obtained from cross-sectional studies (such as the baseline survey of the Scottish Heart Health Study (SHHS; Smith *et al.* 1989)) may be usefully interpreted.

In the SHHS, socio-demographic and full smoking details were elicited from a random sample of middle-aged men and women. (The biochemical markers of smoking, serum cotinine and expired air CO were also measured.) A preliminary report from the SHHS presented nutrient intakes of current, never- and ex-smokers (Bolton-Smith *et al.* 1991c). It illustrated that the diets of ex-smokers were generally more similar to those of never-smokers than current-smokers. However, the ex-smokers were not a homogeneous group, for the period of abstinence ranged from less than 6 months to 50 years. The sample size (10359) in the SHHS is sufficiently large to allow sub-division of ex-smokers according to duration, and comparison to be made with current- and never-smokers. Thus, in order to assess the possible contribution from diet to the reduction in CHD risk (which is reported to occur) on cigarette quitting, the effect of duration of ex-smoking on diet is examined.

SUBJECTS AND METHODS

Current-smokers (people smoking at least one cigarette per d), never-smokers and ex-smokers (ex-regular smokers in groups 1–5 according to duration of quitting: (1) less than 6 months, (2) 6–11 months, (3) 1–4 years, (4) 5–9 years and (5) 10 or more years) were identified from questionnaire data which were collected in the SHHS. This was a baseline cross-sectional study of 10359 Scottish men and women aged 40–59 years. The full protocol has been reported previously (Smith *et al.* 1989; Tunstall-Pedoe *et al.* 1989). Current cigar and pipe smokers were excluded from all the groups except the current (cigarette)-smoking group. Those people who reported to be on a medically prescribed diet were also excluded from these analyses.

Diet was assessed by a food-frequency questionnaire (Yarnell *et al.* 1983) which included questions on the weekly consumption of fifty food items or groups and the weekly family consumption of butter, margarine, vegetable oils, cheese, cream and table sugar. Alcohol was assessed by a 7 d recall question. Mean daily nutrient intakes were calculated by a computer program using standard portion sizes and the McCance and Widdowson food tables (Paul & Southgate, 1978). Details of the use and validations of the food-frequency questionnaire in this population have been reported previously (Bolton-Smith & Milne, 1991; Bolton-Smith *et al.* 1991a,b).

Statistical analysis

Skewed nutrient distributions were normalized by appropriate natural logarithm, square root or arcsine square root transformations before analysis. Energy-adjusted mean daily

nutrient intakes (percentage of energy) and nutrient densities (amounts per 4.2 MJ (1000 kcal)) are expressed inclusive of energy from alcohol. The untransformed mean values and standard deviations are presented (Tables) or means with their standard errors (Figures). Differences between the current- and never-smoking groups and between the five ex-smoking groups were tested for significance by analysis of covariance. The covariates were age and social class according to occupation (Office of Population Censuses and Surveys, 1980), with women being classified according to their husbands' occupation and the unemployed by their last job.

The ability of the nutrients to discriminate between current- and never-smokers was assessed by linear discriminant analysis for men and women separately. This was done by entering all the dietary variables into the analysis and using a stepwise method with a cut-off value of four for the *F* statistic when maximizing the Mahalanobis distance between groups (Morrison, 1975). The discriminant function was then used to classify ex-smokers (in groups 1–5) as 'current-smokers' or 'never-smokers'. The percentage allocation for each ex-smoking group was assessed for significant difference from 50% by the method of least significant difference. Individual nutrients were treated similarly (without the stepwise approach).

RESULTS

According to the current criteria, satisfactory smoking and dietary information were obtained from 4770 women and 4265 men. The numbers and selected characteristics of the smoking groups are given in Table 1. The median durations of ex-smoking were: group 1, 3 months; group 2, 9 months; group 3, 2 years; group 4, 7 years for men and 6 years for women; group 5, 18 years. The majority (58% men, 52% women) of ex-smokers quit 10 or more years ago, and a greater percentage of women (13.2) than men (7.6%) reported a duration of abstinence of less than 1 year. Neither the maximum number of cigarettes smoked daily nor the number of years of smoking appeared to differ greatly between the current-smokers and the ex-smokers of up to 10 years duration. The median age at which people started smoking was 18 years for women in all smoking groups and also for men who quit 6–11 months ago. For male current-smokers and ex-smokers of < 6 months and 5–9 years the median starting age was 16 years, and for the remaining two ex-smoking groups it was 17 years.

Manual occupation predominated in the current-smoking group for both sexes. Median cotinine levels in all ex-smoking groups were low. However, when the number of 'biochemical deceivers' was estimated, by taking those individuals with serum cotinine levels > 17.5 ng/ml and expired air CO levels > 6 ppm (Woodward & Tunstall-Pedoe, 1992), the percentage falling into this category for male ex-smoking groups 1–5 were 12, 8.3, 2.4, 1.2 and 0.6 respectively. For women, the corresponding values were 7.8, 6.7, 3.6, 1.9 and 0.8%. No differences occurred between the ex-smoking groups in the percentage reporting serious illness (angina, heart attack, hypertension, stroke or diabetes) for men or women, although the current- and ex-smokers (as a single group) reported a higher incidence of angina, heart attack and hypertension than did never-smokers. Body mass index (BMI; kg/m²) was lower in current- than never-smokers, and tended to increase with duration of ex-smoking. A greater percentage of ex-smokers reported to be on self-prescribed slimming diets (the exclusion criteria included medically-prescribed slimmers). The percentages slimming for male current-, ex-(1–5) and never-smoking groups were 1.8, 3.4, 2.7, 10.2, 7.9, 5.1 and 2.7 respectively, and the corresponding values for women were 8.8, 14.3, 19.6, 17.1, 15.6, 16.5 and 12.5 respectively.

Tables 2 and 3 show the mean total energy and amounts of nutrients consumed daily by smoking group for men and women. Significance levels for differences between current- and

Table 1. *Characteristics of the smoking groups*
 [Mean or median values with standard (SD) or quartile (QD) deviations respectively]

Smoking group...	Current	Ex-smokers*					Never
		1	2	3	4	5	
Men							
<i>n</i> †	1920	58	36	167	252	710	1122
Age (years)							
Mean	49.3	49.3	50.3	50.1	49.9	51.1	49.1
SD	5.7	5.4	6.2	5.8	5.9	5.8	5.6
Manual occupation (%)	69	55	65	53	60	48	46
Serum cotinine (ng/ml)							
Median	284	6.5	1.8	1.6	0.5	0.4	0.6
QD	95	25	7.5	2.5	1.5	1.4	1.5
Maximum no. of cigarettes smoked (/d)							
Median	20	20	25	20	20	20	—
QD	10	13	9	10	11	10	—
No. of years smoked							
Median	32.0	32.5	31.0	31.0	28.0	15.0	0
QD	10.0	12.3	15.0	11.0	11.0	13.0	0
BMI (kg/m ²)							
Mean	25.4	25.6	26.8	27.4	27.1	26.4	26.3
SD	3.0	3.2	3.7	3.6	3.0	3.1	3.2
Women							
<i>n</i> †	1844	77	45	169	154	480	2001
Age (years)							
Mean	49.2	49.2	49.0	50.3	49.0	49.9	49.5
SD	5.8	6.2	6.8	5.8	6.0	6.1	5.7
Manual occupation (%)	64	42	40	45	45	39	47
Serum cotinine (ng/ml)							
Median	243	2.7	1.3	1.1	0.02	0.01	0.01
QD	93	3.3	1.8	1.6	1.3	1.0	0.9
Maximum no. of cigarettes smoked (/d)							
Median	18	18	15	20	15	10	—
QD	8	5	5	5	5	8	—
No. of years smoked							
Median	30	29.0	28.0	29.0	23.0	12.0	0
QD	11.0	12.0	16.0	11.0	10.5	13.0	0
BMI (kg/m ²)							
Mean	25.1	25.9	25.6	26.2	26.2	25.2	26.1
SD	4.1	5.4	3.4	4.3	4.7	4.1	4.2

BMI, body mass index (weight/height²).

* Grouped according to duration of ex-smoking: 1, < 6 months; 2, 6–11 months; 3, 1–4 years; 4, 5–9 years; 5, ≥ 10 years.

† No. for which nutrient results were also available: *n* varied slightly for different variables.

never-smokers and between the ex-smoking groups as measured by analysis of covariance (adjusting for age and social class) are given for these values and for the respective energy-adjusted values which are presented in Fig. 1. These plots illustrate the differences in energy-adjusted nutrient intakes between the sexes and between the smoking groups. Downwards trends occurred (from current-smokers through the five ex-smoking groups to never-smokers) for total energy and the percentage energy from sugar for men, and for cholesterol (mg/4.2 MJ) for women. An upwards trend occurred for the percentage energy

Table 2. Mean daily nutrient intakes of men according to smoking group

(Mean values and standard deviations; values have been rounded to whole numbers except energy and vitamin E)

Smoking group...	Current (C)		1		2		3		4		5		Never (N)		ANOVA (g/density)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	C	v. N	
	Ex-smokers		Ex-smokers		Ex-smokers		Ex-smokers		Ex-smokers		Ex-smokers		Ex-smokers		Ex-smokers		
Energy	10.5	2.7	10.4	2.2	9.7	2.3	9.6	2.3	9.7	2.5	9.4	2.4	9.3	2.3	***	***	NS
MJ	2516	642	2486	534	2315	546	2303	545	2314	588	2246	569	2217	555	***	***	NS
Protein (g)	90	22	94	40	90	29	87	21	88	20	86	20	85	21	***	+/+++	NS/†
Fat (g)	92	33	94	42	92	39	84	30	84	32	87	30	85	29	***	+/+++	NS/NS
SFA (g)	42	14	43	18	41	19	38	12	38	13	39	14	39	13	***	+/††	NS/NS
PUFA (g)	11	5	12	7	11	5	12	5	12	5	12	5	12	5	*/+++	*/+++	NS/†
Starch (g)	177	62	195	96	169	60	166	59	176	58	169	54	169	56	NS	+/+++	*/+++
Sugar (g)	121	56	124	49	115	52	103	47	100	46	92	37	93	36	***	+/+++	*/+++
Fibre (g)	20	6.9	22	11	20	7.5	21	7.0	22	7.5	22	7.4	23	8.0	***	+/+++	NS/+/+++
Cholesterol (mg)	429	155	432	268	440	179	393	164	386	164	370	144	361	140	***	+/+++	*/NS
Alcohol (g)	27	29	21	22	23	26	23	22	19	21	19	23	16	19	***	+/+++	NS/NS
Vitamin C (mg)	49	20	53	25	54	22	56	24	55	21	53	21	56	22	***	+/+++	NS/NS
Vitamin E (mg)	6.5	4.4	7.2	6.4	6.7	5.1	7.9	5.3	7.3	5.0	7.9	5.3	7.9	5.7	***	+/+++	NS/NS
Retinol (μ g)	811	502	783	768	717	341	723	383	693	439	697	400	698	337	***	+/+++	NS/NS
Carotene (μ g)	3063	2167	3038	2100	2982	1853	3168	1898	3143	2146	3303	2105	3400	2269	**	+/+++	NS/NS
Vitamin A (μ g)	1318	655	1295	997	1207	520	1248	552	1220	587	1248	566	1265	568	NS	+/+++	NS/NS
PUFA:SFA	0.29	0.02	0.30	0.02	0.29	0.02	0.34	0.01	0.34	0.01	0.34	0.01	0.33	0.02	+/†††	+/†††	/NS

SFA, saturated fat; PUFA, polyunsaturated fat.

ANOVA, analysis of covariance on appropriately transformed data (adjusted for age and social class) for C v. N smokers and separately for the ex-smoking groups: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ for amounts per d.; † $P < 0.05$, †† $P < 0.01$, ††† $P < 0.001$ for % energy and nutrient density values (not shown). NS, not significant.‡ Grouped according to duration of ex-smoking: 1, < 6 months; 2, 6–11 months; 3, 1–4 years; 4, 5–9 years; 5, ≥ 10 years.

Table 3. Mean daily nutrient intakes of women according to smoking group

(Mean values and standard deviations; values have been rounded to whole numbers except energy, alcohol and vitamin E)

Smoking group...	Ex-smokers												ANOVA			
	Current (C)		1		2		3		4		5		Never (N)		(g/density)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	C v. N	Ex-smokers
Energy MJ	7.6	2.2	7.4	2.5	7.0	1.9	7.1	2.0	7.2	1.6	7.2	1.7	7.3	1.8	*	NS
kcal	1815	520	1757	588	1675	452	1703	471	1727	389	1724	413	1743	438	*	NS
Protein (g)	75	20	75	22	72	15	74	18	75	16	75	17	75	18	NS/†††	NS/NS
Fat (g)	79	27	76	30	73	25	74	26	75	23	73	24	76	24	NS/NS	NS/NS
SFA (g)	37	13	35	14	33	14	33	12	34	12	33	11	35	12	*/NS	NS/NS
PUFA (g)	9	4	9	4	9	3	10	5	10	5	10	5	10	5	***/†††	NS/NS
Starch (g)	118	48	122	51	113	42	115	46	115	38	118	41	119	42	NS/†††	NS/NS
Sugar (g)	81	44	69	35	69	29	70	27	71	26	71	25	73	26	***/NS	NS/NS
Fibre (g)	17	6.8	21	7.1	20	7.1	20	7.0	20	6.1	21	7.3	20	7.0	***/†††	NS/NS
Cholesterol (mg)	354	128	343	153	306	106	323	120	324	112	320	118	325	112	***/††	NS/NS
Alcohol (g)	7.3	9.7	7.4	10	7.1	6.9	6.8	8.0	7.4	7.8	7.2	8.3	4.6	6.6	***/†††	NS/NS
Vitamin C (mg)	46	22	54	24	54	24	56	25	57	24	56	25	55	24	***/†††	NS/NS
Vitamin E (mg)	5.7	4.0	6.0	3.9	6.4	3.6	7.3	5.6	7.1	5.0	7.2	5.6	6.9	5.1	***/†††	NS/NS
Retinol (µg)	739	470	740	482	716	454	699	371	719	386	650	340	687	393	NS/NS	NS/NS
Carotene (µg)	3177	2335	3569	2370	3132	2206	3696	2306	3564	2218	3660	2149	3451	2210	NS/††	NS/NS
Vitamin A (µg)	1262	658	1335	678	1237	609	1322	585	1297	510	1259	524	1261	557	NS/NS	NS/NS
PUFA:SFA	0.27	0.02	0.30	0.02	0.33	0.03	0.33	0.02	0.31	0.01	0.33	0.01	0.30	0.01	/†††	/NS

SFA, saturated fat; PUFA, polyunsaturated fat.

ANOVA, analysis of covariance on appropriately transformed data (adjusted for age and social class) for C v. N smokers and separately for the ex-smoking groups: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ for amounts per d; † $P < 0.05$, †† $P < 0.01$, ††† $P < 0.001$ for % energy and nutrient density values (not shown). NS, not significant.

‡ Grouped according to duration of ex-smoking: 1, < 6 months; 2, 6-11 months; 3, 1-4 years; 4, 5-9 years; 5, ≥ 10 years.

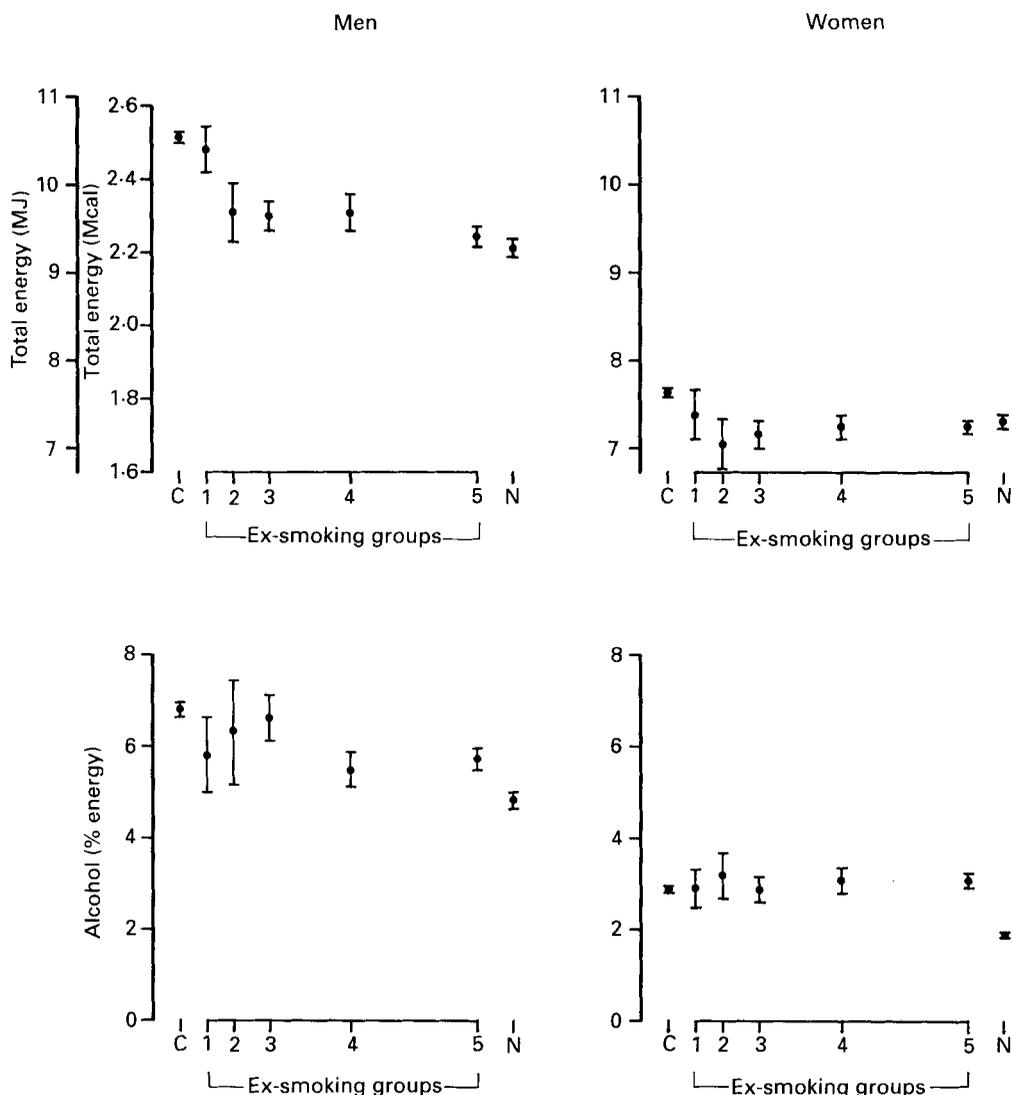


Fig. 1. (continued on pp. 322–327). Energy-adjusted nutrient intakes according to smoking group. Macro-nutrients expressed as percentage energy and other nutrients expressed on a per 4.2 MJ (1000 kcal) basis, inclusive of alcohol. Ex-smoking groups: 1, < 6 months; 2, 6–11 months; 3, 1–4 years; 4, 5–9 years; 5, \geq 10 years. Median duration of ex-smoking for each group plotted: 1, 3 months; 2, 9 months; 3, 2 years; 4, 7 years for men and 6 years for women; 5, 18 years. For statistical significance of differences (by analysis of covariance) between the current (C)- and never (N)-smoking groups, and between the ex-smoking groups, see Tables 2 and 3 for men and women respectively. Values are means with their standard errors represented by vertical bars. (For visual approximation; where the standard error bars do not overlap, statistical significance ($P < 0.05$) is likely.) For details of subjects and groups, see Table 1 and p. 316. PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids.

from protein and the nutrient densities for fibre and carotene for men, and for the percentage of energy from polyunsaturated fatty acids and the nutrient densities for vitamin C and E for both men and women.

The decline in energy intake from current-smokers through to never-smokers for men is not entirely a result of the declining alcohol consumption across these same groups: the

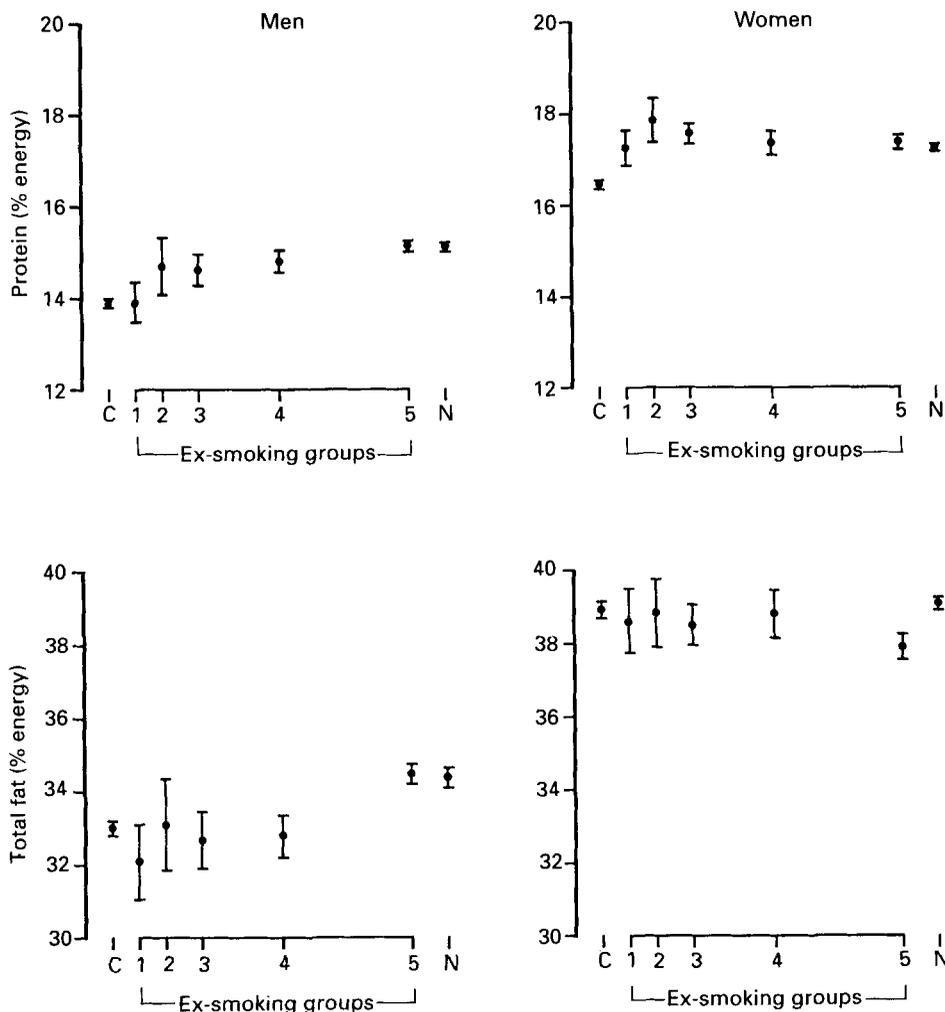


Fig. 1. (contd.). For legend see p. 321.

trends in nutrient intakes are maintained when energy from alcohol is excluded (results not shown). For men, the percentage of the energy change which can be attributed to decreased intake of alcohol for the ex-smoking groups 2-5 are respectively 13.9, 13.1, 27.7 and 25.8. The lower sugar consumption in men according to duration of ex-smoking accounts for more of the energy difference (11.2, 31.7, 39.0, 40.3 and 35.1% in the ex-smoking groups 2-5 and never-smokers respectively). For women, alcohol consumption does not decrease on quitting but 26.1% of the energy difference between current- and never-smokers can be attributed to lower alcohol intake.

The percentage of non-tea and non-coffee drinkers and the percentage who consume at least six cups per d of each are shown in Table 4 by smoking group. The median number of cups of tea and coffee reported to be drunk per d (excluding the non-drinkers) is also given. The results of chi-square tests between the ex-smoking groups are given. For men, heavy coffee drinking was less prevalent in ex-smokers of at least 5 years duration, while for women the ex-smokers of 6-11 months duration drank appreciably more coffee than those in the other groups.

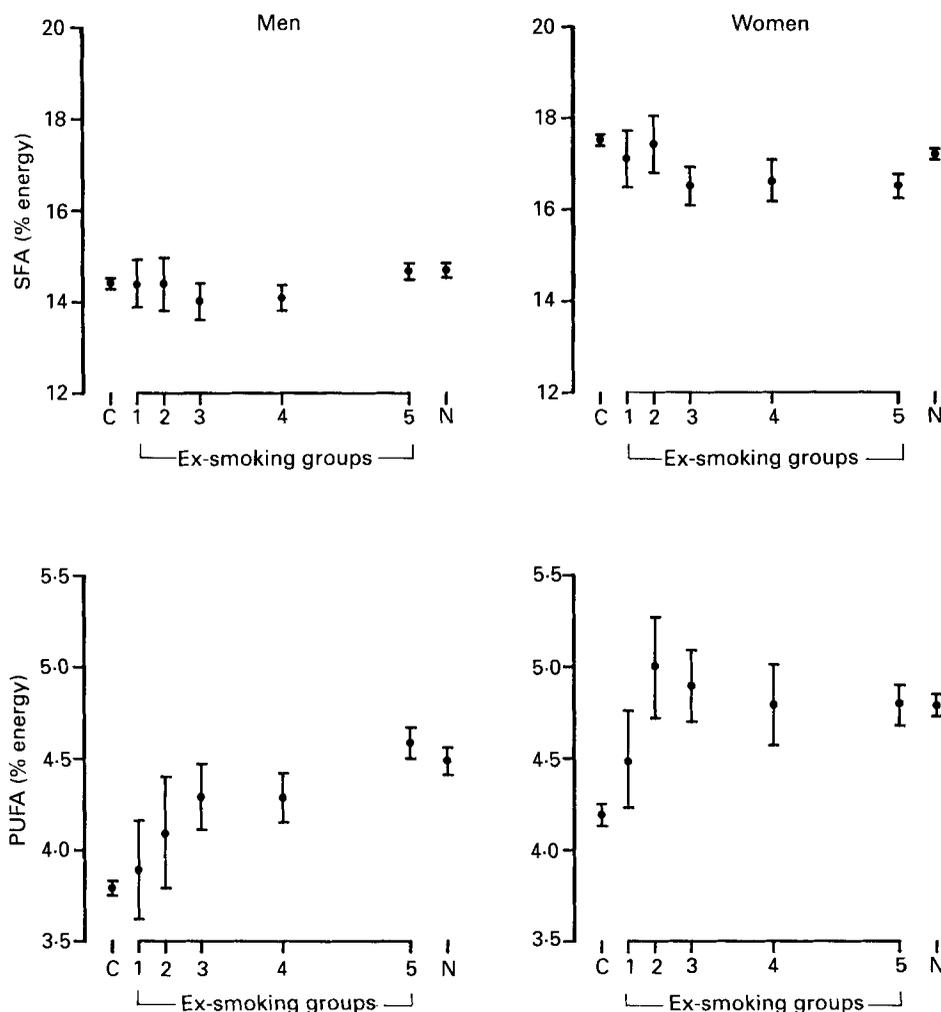


Fig. 1. (contd.). For legend see p. 321.

Results of the discriminant analyses are presented as block diagrams. Fig. 2 shows those individual nutrient variables which discriminate between the current- and never-smokers and which allocate at least some of the ex-smoking groups into the current- or never-smoking categories to a significant extent. More nutrient variables discriminate current- from never-smokers for men than for women. The best discriminators for men were fibre (g/4.2 MJ) and percentage energy from protein, which correctly categorized 74 and 61% of current-smokers, and 58 and 61% of never-smokers respectively. For women, fibre (g/4.2 MJ) provided the best discrimination between the current (67% correct)- and never (54% correct)-smokers. Women who were ex-smokers remained equivalent to current-smokers with respect to alcohol intake but with respect to fibre intake resembled never-smokers within 6 months of quitting. For men, ex-smokers remained more similar to current-smokers for times varying from 6 months to 3 years depending on the nutrient.

When all the nutrient variables were used to discriminate between the current- and never-smokers (Fig. 3), discrimination was better for men (71%) than women (65%). However,

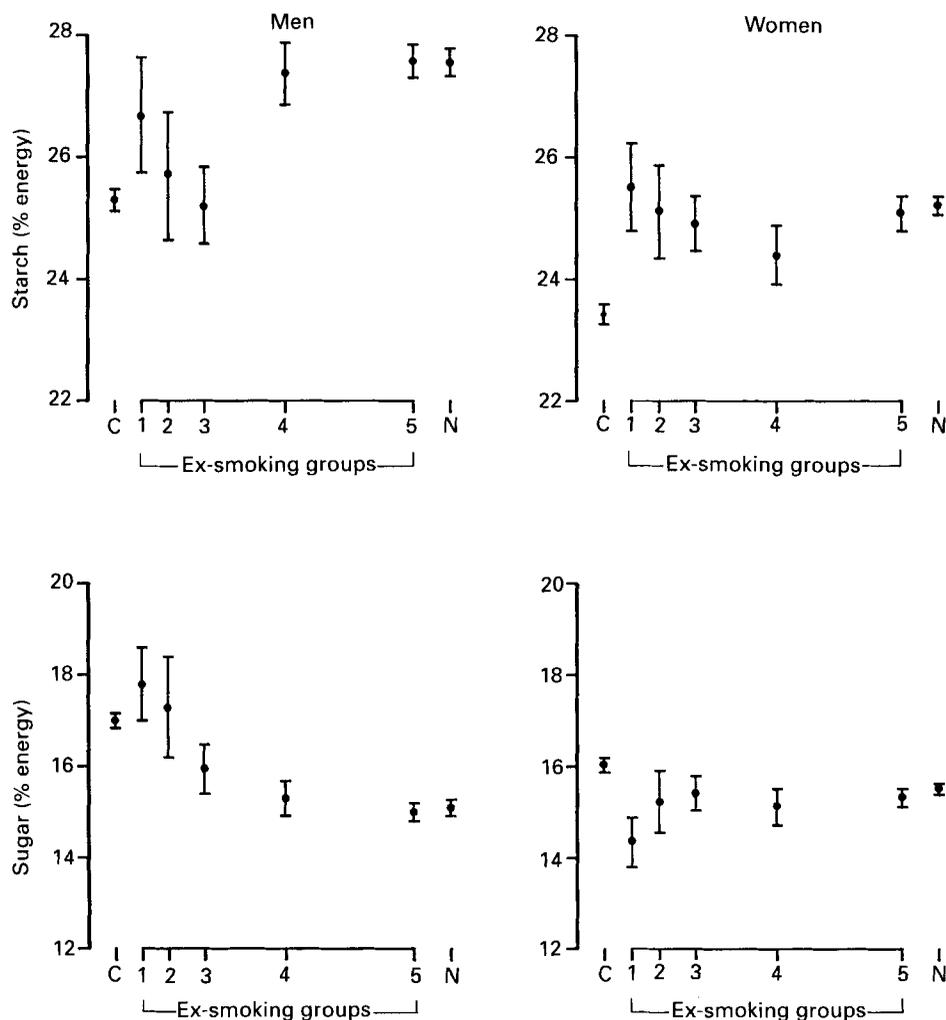


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for both sexes, allocation of the ex-smokers into the current-smoking category was non-significant by 6 months after quitting, and they could only be allocated (significantly) into the never-smoking category after 4 years of abstinence.

DISCUSSION

Detailed analysis of diet in ex-smoking groups of different duration has not previously been reported. While the results show that differences do occur between the current-smoking and ex-smoking groups, it is not clear to what extent these differences are a direct consequence of the smoking history or are a result of intrinsic characteristics of the groups, independent of smoking (cohort effect). The higher percentage of 'biochemical deceivers' in the first two ex-smoking groups also suggests that some of them were still smoking, at least occasionally, or chewing nicotine gum (which was not assessed).

Prospective and intervention studies (Gordon *et al.* 1975; West *et al.* 1977; Friedman *et al.* 1979) suggest that quitters differ intrinsically from those who continue to smoke with

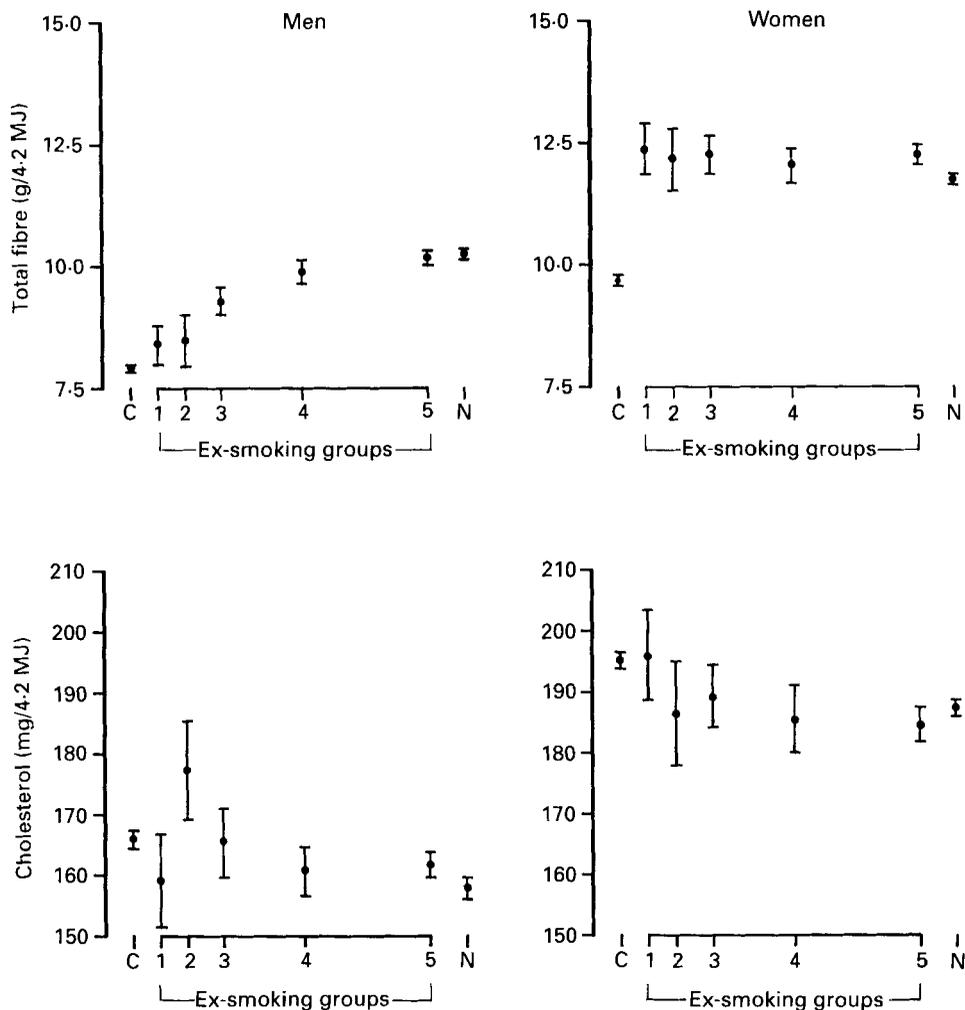


Fig. 1. (contd.). For legend see p. 321.

respect to the age at which they commenced smoking, the number of years smoked and the numbers of cigarettes smoked per d. Ex-smokers are generally likened more to never-smokers in psychological and socio-demographic characteristics and in their risk profile for CHD (West *et al.* 1977; Kaprio & Koskenvuo, 1988). In the SHHS population, never-smokers tended to be of higher socio-economic standing (with respect to occupation, education and housing) and have better health knowledge and health-associated activities (such as trying to take more exercise and trying to eat less fat) (C. A. Brown and C. Bolton-Smith, unpublished results). While ex-smokers in the SHHS do tend to be better educated and more live in their own homes than do current-smokers, for many other characteristics (such as age and the percentage manually employed) ex-smokers tend to fall between the current- and never-smokers. The lack of any major differences in the median (or mean) age at which smoking commenced, in the number of cigarettes smoked per d, or in the total years of smoking, between the current-smokers and the ex-smokers of up to 9 years duration indicates that there are few intrinsic (cohort) differences between the groups with respect to smoking characteristics. While these results contrast with other studies (e.g.

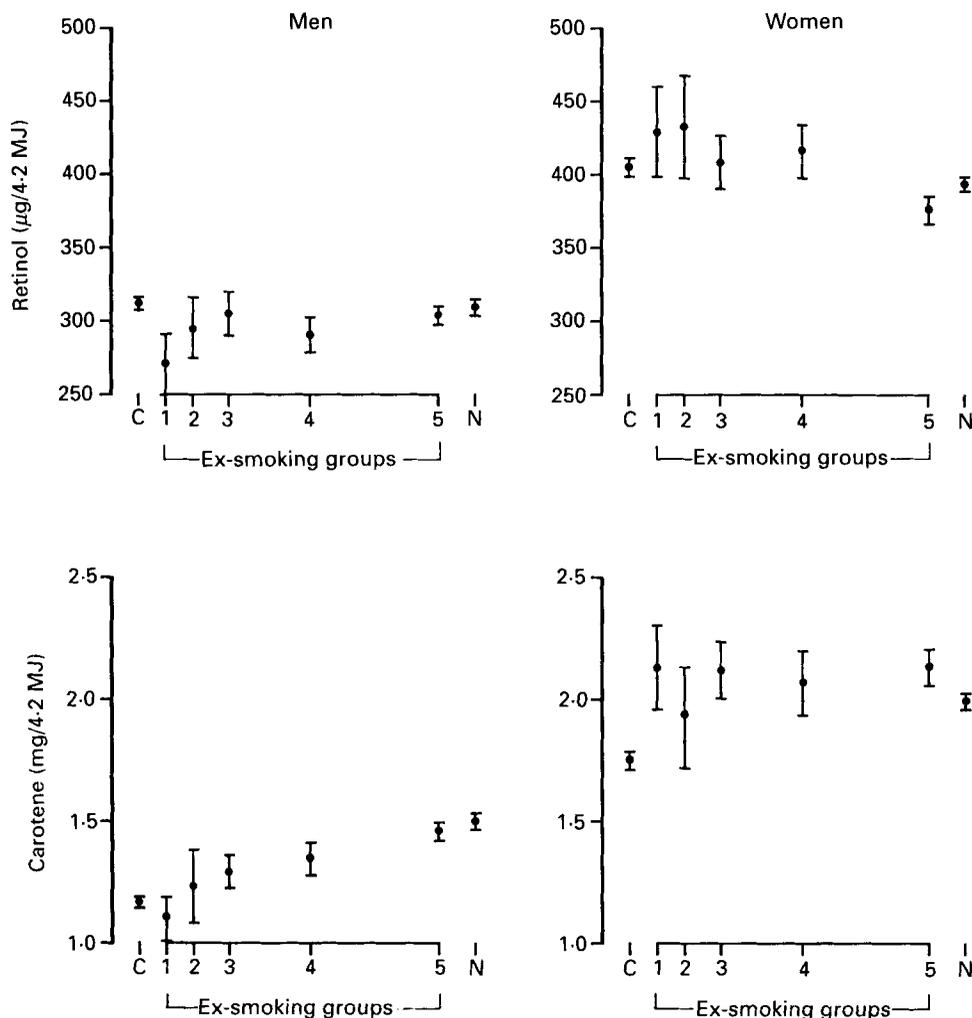


Fig. 1. (contd.). For legend see p. 321.

Friedman *et al.* 1979), different social pressures may be expected to predominate in different countries, and differences between quitters and non-quitters in withdrawal-clinic follow-up studies (e.g. West *et al.* 1977) and in CHD patients (e.g. Ockene *et al.* 1985) are unlikely to be representative of the general population.

Although interpretation of these cross-sectional results in a quasi-longitudinal manner cannot be entirely appropriate, the numerous clear trends in nutrient intakes from current-smokers through the ex-smoking groups to the never-smokers provides 'circumstantial evidence' to support this approach. Furthermore, there is no evidence from the SHHS to suggest that differential reporting of food frequencies (non-random bias) occurs according to duration of ex-smoking, or between current- and never-smokers.

For both sexes there appears a tendency for the composition and the quality of the diet to be healthier in the ex-smoking groups than in the current-smokers: polyunsaturated fatty acids (PUFA), fibre and the vitamins are higher, and for men only the percentage energy from sugar and alcohol are lower. Heavy coffee consumption (≥ 6 cups/d) also tends to be less common as the duration of ex-smoking increases. Kato *et al.* (1989) found

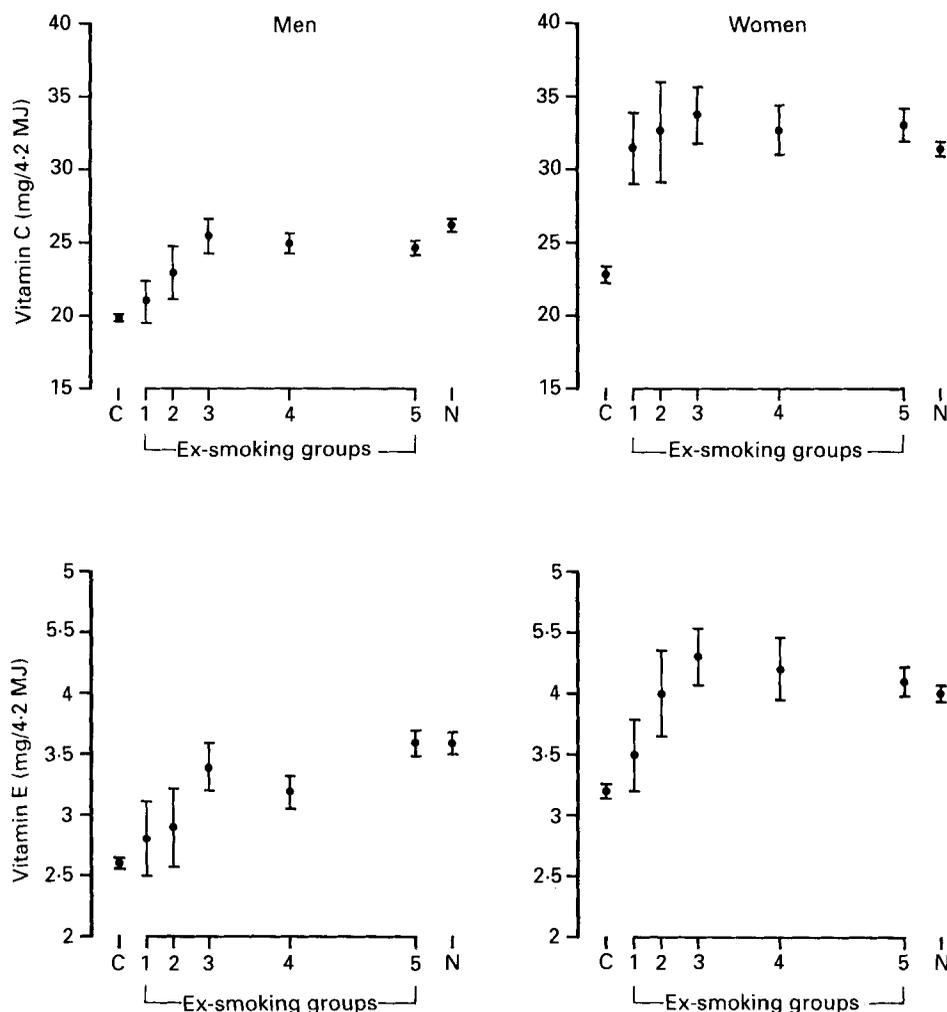


Fig. 1. (contd.). For legend see p. 321.

what can be considered similar results in Japanese ex-smokers, for alcohol and coffee consumption were down and bread and fruit and vegetables were increased in the diets of ex-smokers. Lincoln (1969), in a rather anecdotal letter, reported very similar differences in energy intake between current- and never-smokers, and between current- and ex-smokers as are found here. It is particularly inappropriate that current-smokers and recent ex-smokers have the lowest intake of the antioxidant vitamins, since it is these individuals who probably have the highest requirements for combating free-radical damage (Kallner *et al.* 1981; Stryker *et al.* 1988; Bolton-Smith *et al.* 1991a). The higher intake of vitamin C, E and β -carotene in long-term quitters may be contributing to the overall health benefits which are associated with not smoking.

For men, the diet appears to improve with duration of ex-smoking and reaches approximately the level of nutrient intakes in the never-smokers by 10 years of smoking cessation. The initial rise in the percentage energy from sugar and then progressive fall with duration of ex-smoking may be the result of immediate compensatory eating of sweets instead of smoking, followed by a combination of altered taste preference and the cutting-

Table 4. *Tea and coffee consumption according to smoking group*
 [Medians and quartile deviations (QD)]

	Current	Ex-smokers*					Never	Statistical significance between ex-smoking groups (χ^2 test): <i>P</i>
		1	2	3	4	5		
Men								
Coffee								
Not drinking (%)	30	22	38	29	30	28	28	NS
Drinking \geq 6 cups/d (%)	19	16	19	17	12	8	8	< 0.001
No. of cups† (/d)								
Median	4	4	4	3	3	3	3	—
QD	4	3	3	3	3	3	2	
Tea								
Not drinking (%)	12	10	14	13	12	10	10	NS
Drinking \geq 6 cups/d (%)	32	31	32	29	29	28	22	NS
No. of cups† (/d)								
Median	2	2	3	2	2	2	2	—
QD	6	6	6	7	6	7	7	
Women								
Coffee								
Not drinking (%)	28	27	4	21	21	17	27	< 0.05
Drinking \geq 6 cups/d (%)	23	13	33	18	16	14	10	< 0.05
No. of cups† (/d)								
Median	4	3	5	3	3	3	3	—
QD	4	3	4	3	3	3	2	
Tea								
Not drinking (%)	15	14	26	11	12	15	9	NS
Drinking \geq 6 cups/d (%)	31	25	20	25	24	19	26	NS
No. of cups† (/d)								
Median	2	8	1	8	8	2	8	—
QD	7	7	3	7	7	6	7	

NS, not significant.

* Grouped according to duration of ex-smoking: 1, < 6 months; 2, 6–11 months; 3, 1–4 years; 4, 5–9 years; 5, \geq 10 years.

† Median no. of cups drunk per d, excluding non-drinkers.

out of sugar to resist weight gain. The higher PUFA, fibre and vitamin intakes could suggest either increasing health awareness and long-term changing of dietary habits, or a cohort effect. It is possible that those people who quit earlier may just be intrinsically more health conscious. However, for women the higher intake of these nutrients (and the decrease in sugar) tends to be most pronounced immediately on quitting smoking and the levels plateau off towards the never-smokers' intakes with further duration of smoking cessation. Two interpretations of these results for women seem possible: either that ex-smokers are women with virtually the same characteristics as never-smokers and at no time 'behaved' like current-smokers in any way, or that personal health and social pressures act far more strongly on women than on men such that virtually as soon as they stop smoking concomitantly other healthier life-styles (including dietary) are taken on board. For men, pressures to retain their pre-quitting weights may be less and so less conscious dietary control may be exercised. The lower energy intake for both sexes on quitting and the apparent inverse relationship between energy intake and BMI may be partly due to the

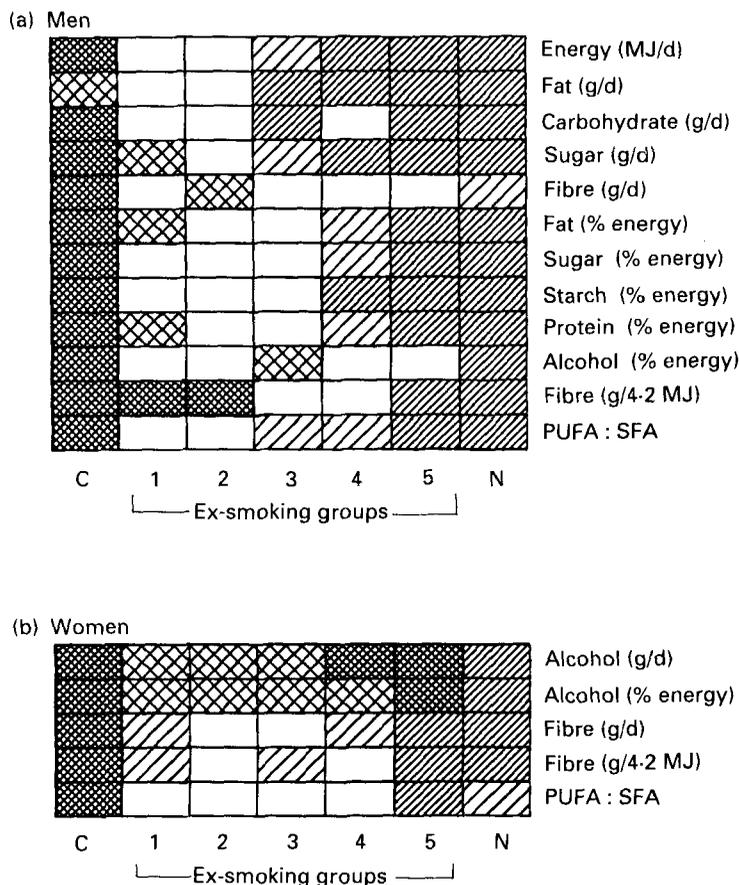


Fig. 2. Nutrients whose discriminant factors allocate the ex-smoking groups (1–5) to the current (C)- or never (N)-smoking categories with a specificity significantly greater than 50% by the least significant difference method. (Nutrients not shown gave no significant discrimination between C- and N-smoking categories.) Ex-smoking groups: 1, < 6 months; 2, 6–11 months; 3, 1–4 years; 4, 5–9 years; 5, \geq 10 years. PUFA : SFA, polyunsaturated : saturated fat. For details of subjects and groups, see Table 1 and p. 316. \blacksquare , > 50% allocated to C-smoking category $P < 0.01$; \boxtimes , > 50% allocated to C-smoking category $P < 0.05$; \boxdot , > 50% allocated to N-smoking category $P < 0.01$; \boxminus , > 50% allocated to N-smoking category $P < 0.05$; \square , No significant allocation to C- or N-smoking category.

metabolic effects of nicotine and nicotine withdrawal, as suggested previously (Wack & Rodin, 1982). This relationship will be investigated in more detail in a subsequent report, since levels of physical activity must also be considered in the energy equation.

The results of the discriminant analyses using the individual nutrients further illustrated the greater similarity of diets between the smoking groups for women compared with men. Ex-smoking women retained the alcohol consumption pattern of current-smokers, perhaps because alcohol is often disregarded in the energy equation and no other reason for reducing intake is present. Fibre showed a different pattern since ex-smokers immediately had the consumption level of never-smokers. The opposite patterns for these two nutrients could be construed as further evidence against specific cohort effects. However, although it may seem unlikely that the majority of ex-smoking women are people who (regardless of smoking history) consume relatively high-alcohol and high-fibre diets, this pattern is characteristic of the higher social classes (Bolton-Smith *et al.* 1991b).

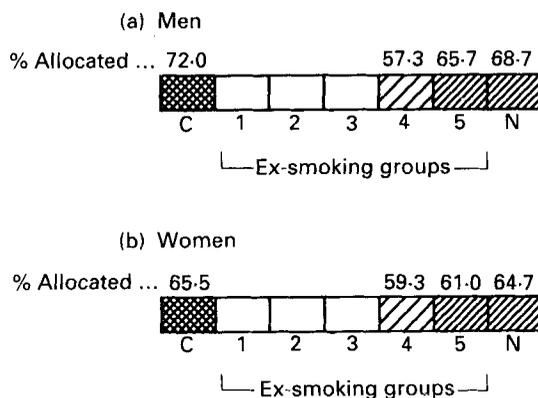


Fig. 3. Allocation of the ex-smoking groups (1-5) to the current (C)- or never (N)-smoking categories, with a specificity significantly greater than 50% by the least significant difference method, on the basis of the discriminant function for combined nutrient intake. Ex-smoking groups: 1, < 6 months; 2, 6-11 months; 3, 1-4 years; 4, 5-9 years; 5, ≥ 10 years. For details of subjects and groups, see Table 1 and p. 316. \blacksquare , > 50% allocated to C-smoking category $P < 0.01$; \square , > 50% allocated to N-smoking category $P < 0.01$; \square , > 50% allocated to N-smoking category $P < 0.05$; \square , No significant allocation to C- or N-smoking category.

For men, it appears as if after 1 year of smoking cessation the energy intake and amounts of fat and carbohydrate are similar to never-smokers, but that the percentage contributions of the different nutrients to energy intake do not approximate those of the never-smokers until at least 5 years of cessation. The results of Kato *et al.* (1989) show similar variation in the time-periods before the patterns of food consumption in the ex-smokers resemble more closely the pattern of the never-smokers.

The discriminant function for the combined nutrients increased the power of the diet to categorize correctly current- and never-smokers for both men and women, and suggests that the diet of ex-smokers of 5 or more years duration is generally similar to that of never-smokers. This time-period is in good agreement with the reported times required for past smokers to lose their excess risk of CHD (e.g. Doll & Peto, 1976; Rosenberg *et al.* 1985, 1990). However, it is contended that CHD risk may actually be lower in ex- than in never-smokers, and the 'conventional wisdom' regarding smoking and the risk of CHD is questioned (Seltzer, 1989). Thus, over-interpretation and over-simplification of these results must be avoided. Given the recognized difficulties in assessing diet and nutrient intake (e.g. Cameron & Van Staveren, 1988), in future the method for classifying smokers is unlikely to change. However, it is plausible that dietary factors contribute to the excess CHD risk of smokers and conversely that if people improve their diet (with respect to fat, fibre and vitamin intakes) on quitting smoking, they may contribute further to their reduction in coronary risk.

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