



**QUEEN'S
UNIVERSITY
BELFAST**

Characteristics of Male Vitamin supplement users aged 50-59 years in France and Northern Ireland the Prime Study

Marques-Vidal, P., Arveiler, D., Evans, A., Montaye, M., Ruidavets, J. B., Haas, B., ... Ducimetiere, P. (2000). Characteristics of Male Vitamin supplement users aged 50-59 years in France and Northern Ireland the Prime Study. *International Journal of Vitamin Nutrition Research*, 70(3)(3), 102-109.

Published in:

International Journal of Vitamin Nutrition Research

Queen's University Belfast - Research Portal:

[Link to publication record in Queen's University Belfast Research Portal](#)

General rights

Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact openaccess@qub.ac.uk.

Reprint from

International
Journal for
**Vitamin
and Nutrition
Research**



Hogrefe & Huber Publishers
Toronto Seattle Bern Göttingen

Characteristics of Male Vitamin Supplement Users Aged 50–59 Years in France and Northern Ireland: the Prime Study

Pedro Marques-Vidal¹, Dominique Arveiler², Alun Evans³,
Michèle Montaye⁴, Jean Bernard Ruidavets¹, Bernadette Haas²,
John Yarnell³, Annie Bingham⁵, Jean Ferrières¹, Philippe Amouyel⁴ and
Pierre Ducimetière⁵

¹ INSERM U518, Faculté de Médecine Purpan, Toulouse, France

² MONICA-Strasbourg, Laboratoire d'Epidémiologie et de Santé Publique, Strasbourg, France
³ Belfast-MONICA, Department of Epidemiology, The Queen's University of Belfast, Belfast UK

⁴ MONICA-Lille, Institut Pasteur de Lille, Lille, France
⁵ INSERM U258, Hôpital Paul Brousse, Villejuif, France

Received for publication: July 22, 1999

Abstract: The prevalence and characteristics of vitamin supplement users were assessed in 7538 male subjects aged 50–59 from France and 2468 from Northern Ireland.

In France, 15% of subjects used vitamin supplements; users were significantly younger, had a lower body mass index, a higher educational level, had more frequently a hard physical job, reported more frequently a personal history of disease and were less frequently retired or inactive than non-users. In Northern Ireland, 21% of subjects were vitamin supplement users; users had a lower body mass index, drank less alcohol, had a higher educational level, were more frequently non-smokers and professionally active, and reported a hard physical job and the practice of leisure sports more frequently than non-users. Finally, vitamin supplement users in Northern Ireland had a lower consumption of alcohol, smoked less, had a lower frequency of personal history of disease and were more frequently on dietary therapy for hypertension or dyslipidaemia than their French counterparts. We conclude that vitamin supplement use is associated with a healthier lifestyle and with dietary measures against hypertension and dyslipidaemia in Northern Ireland. The less favorable lifestyle observed for vitamin supplement users in France awaits further investigation.

Key words: vitamin supplements, epidemiology, socioeconomic status, prevention, hypertension, dyslipidaemia

Introduction

Several prospective studies have shown that supplementation of certain vitamins, e.g. of vitamin C and/or E either

singly or combined within multiple micronutrients can decrease cardiovascular morbidity and mortality [1–5]. Although this is not necessarily so under all conditions and in all study population [6–8], there is an overall belief in

the general population that vitamin supplement use is potentially beneficial for primary prevention in the general population [9–12]. Health benefits are most plausible if the supplementation corrects any previous vitamin inadequacies [13, 14]. Further, some studies have suggested that vitamin supplementation might be of interest in secondary prevention of cardiovascular disease [15, 16].

Thus, vitamin supplementation is relatively common in industrialized countries [11, 17–19], namely among elderly subjects [10, 20–22]. The frequency of vitamin supplement use can be as high as 66% [23] but a declining trend has been shown in the USA [24]. Although most subjects take daily vitamin supplements in moderate doses, some individuals do take considerable and excessive amounts, with possible deleterious effects to their health [18, 25]. Still, the impact of such behavior in Public Health terms has seldom been studied.

In France, few studies have focused on the vitamin status of the general population [26–28], and little is known regarding vitamin supplement use. Also, to our knowledge, no study on the characteristics of the subjects taking vitamin supplements has been performed in France. Thus, we used the data from a large prospective study (PRIME) to assess the frequency and the characteristics of the subjects taking vitamin supplements in France as compared to Northern Ireland.

Subjects and Methods

Population sampling: The PRIME Study (Prospective Epidemiological Study of Myocardial Infarction) was established in 1991 in the populations of four WHO-MONICA collaborating centres of Belfast (United Kingdom), Lille, Strasbourg and Toulouse (France). The target was to recruit 2500 men, aged 50–59 years, in each center and to follow them for a minimum of 5 years. The sample was recruited to match broadly the social class structure of the background population. The sampling frame was based on industry and various employment groups, and on health screening centers and general practice. Participation was voluntary. Subjects were informed of the aim of the study and those who agreed to take part were given a morning appointment and asked to fast for a minimum period of 10 hours.

Personal and medical history: Self-administered questionnaires relating to demographic, socioeconomic factors and diet were completed at home by the participants and checked by the interviewer at the clinic. Data on level of education, occupational activity, personal and family history, tobacco and alcohol consumption and drug intake were collected. Subjects were considered as vitamin sup-

plement users if they answered “yes” to the question “do you take vitamins or tonics containing vitamins?” or if vitamin supplements were derived from the list of drugs provided by the subject.

Height and weight were measured using a wooden and electronic scales, respectively. During measurements, the subject was only partially dressed and without shoes. Height was measured in millimeters and rounded to the nearest centimeter; weight was measured in kg with one decimal and rounded to the nearest 200 gr.

Lipid measurements and definition of hyperlipidaemia: Fasting blood samples were collected after a minimum of a 10-hour fast. Total cholesterol and triglyceride were assayed by enzymatic methods (Boehringer, Mannheim, Germany) adapted to a Hitachi 705 analyzer. The interassay coefficient of variation for total cholesterol and triglyceride were 2% and 3%, respectively.

The definition of hyperlipidaemia was based on the European Atherosclerosis Society guidelines [29]: the subject was considered as hyperlipidaemic if total cholesterol level was ≥ 260 mg/dl and/or triglyceride level was ≥ 200 mg/dl and/or was on hypolipidaemic drug treatment. Awareness of hyperlipidaemia was defined by a positive answer to the question “have you ever been told by a doctor that your cholesterol and/or blood fats were too high?”. Dietary treatment was defined as a positive answer to the question “are you currently on dietary treatment for your cholesterol/blood fats?”. Drug treatment was defined by the subject taking a hypolipidaemic drug.

Blood pressure measurement and definition of hypertension: Blood pressure was measured once at the end of the examination after a 5-minute rest in the sitting position. Measurements were performed with an automatic device (Spengler SP9), which also recorded heart rate. A standard cuff size was used, but a large cuff was available when necessary. At least three measuring devices were available at any time in each center and all three were equally used. In order to avoid systematic differences between centers, the devices were circulated between them. The devices were also recalibrated every 3 months by the co-ordinating center in Paris.

Hypertension was defined according to WHO criteria, i.e. a systolic blood pressure (SBP) ≥ 160 mmHg and/or a diastolic blood pressure (DBP) ≥ 95 mmHg and/or anti-hypertensive drugs. Awareness of hypertension was defined by a positive answer to the question “did a doctor ever tell you that you had high blood pressure levels?”. Dietary treatment was defined as a positive answer to the question “are you currently on dietary treatment for your hypertension?”. Drug treatment was defined as the prescription of an antihypertensive drug.

Statistical analysis: Statistical analysis was conducted using SAS (SAS Institute, Cary, NC, USA) software. Subjects with a personal history of angina pectoris, myocardial infarction or possible coronary heart disease were excluded from the analysis. Data are presented as mean \pm SD or as number of subjects (percentage). Comparisons were performed using Chi-square test for qualitative variables and by Student's *t*-test for quantitative variables. Due to the number of tests performed, statistical significance was considered only for $p < 0.01$.

Results

Prevalence of vitamin supplement use: In all data from 10 006 subjects were analyzed: 7538 from France and 2468 from Northern Ireland. Among those subjects, 1681 reported taking vitamin supplements: 1161 (15%) in France and 520 (21%) in Northern Ireland, $p < 0.001$. Daily vitamin supplements use was reported by 74% of subjects in Northern Ireland, versus only 24% in France ($p < 0.001$).

Characteristics of vitamin supplement users and non-users: In France, subjects taking vitamin supplements were significantly younger, had lower body mass indices, higher educational levels, engaged more frequently on vigorous physical activity outside work, had a history of disease more often and were less frequently retired or inactive (unemployed) than non-users. Those findings were further confirmed by stepwise logistic regression using vitamin supplement use as the dependent variable (not shown). Conversely, no differences were found for alcohol consumption, smoking status, marital status, leisure physical exercise and history of surgery (Table 1). Vitamin supplement users also had a lower prevalence of hypertension (23% vs. 30%, $p < 0.001$) and higher awareness and dietary treatment rates for dyslipidaemia than non-users (79% vs. 72% and 57% vs. 48%, respectively, $p < 0.01$). Further adjustment on age, body mass index, education level or smoking did not change the results (for vitamin users relative to non-users: for hypertension, OR = 0.84, $p < 0.05$; for awareness of dyslipidaemia, OR = 1.36, $p < 0.05$; for dietary treatment of dyslipidaemia, OR = 1.31, $p < 0.01$).

Table 1. Characteristics of male vitamin users and non-users in France. Results are expressed as means \pm SD or as number of subjects (percentage)

	Users (n = 1161)	Non-users (n = 6377)	test
Age (years)	53.6 \pm 2.8	55.0 \pm 2.9	4.5***
Body mass index (kg/m ²)	25.9 \pm 3.0	26.8 \pm 3.5	9.5***
Alcohol consumption (ml/wk)	273 \pm 252	290 \pm 255	2.1 NS
Education			107.6***
≤ 7 years	49 (4.2)	457 (7.1)	
7 < . ≤ 11 years	459 (39.5)	3238 (50.8)	
11 < . < 15 years	346 (29.8)	1681 (26.4)	
≥ 15 years	307 (26.5)	1001 (15.7)	
Marital status			4.0 NS
couple	1000 (86.1)	5627 (88.2)	
single	161 (13.9)	751 (11.8)	
Professional activity			15.3***
active	938 (80.8)	4874 (76.4)	
sick leave	50 (5.3)	247 (3.9)	
retired	93 (8.0)	715 (11.2)	
inactive	80 (6.9)	541 (8.5)	
Smoking status			2.6 NS
non-smoker	298 (25.7)	1780 (27.9)	
ex-smoker	552 (47.5)	2914 (45.7)	
current smoker	311 (26.8)	1683 (26.4)	
Personal history of surgery	30 (2.6)	107 (1.7)	4.5 NS
Personal history of disease	671 (57.8)	3038 (47.6)	40.5***
Vigorous Physical activity	431 (37.1)	1983 (31.1)	16.3***
Leisure sport activity	967 (83.4)	5192 (81.4)	2.3 NS

Analysis by Chi-square or by Student's *t*-test: NS, not significant; * $p < 0.01$; ** $p < 0.005$; *** $p < 0.001$.

In Northern Ireland, vitamin supplement users had lower body mass indices, drank less alcohol, had higher educational levels, were more often non-smokers, professionally active, engaged more frequently on vigorous physical activity outside work and took part in leisure sports than non-users (Table II). Conversely, no differences were found

for age, marital status and personal history of disease or surgery. Finally, vitamin supplement users who were hypertensive or had dyslipidaemia were more frequently on dietary treatment than non-users (53% vs. 10% and 77% vs. 53%, respectively, $p < 0.01$), and those differences remained after adjusting for age, body mass index, educational level

Table II: characteristics of male vitamin users and non-users in Northern Ireland. Results are expressed as means \pm SD or as number of subjects (percentage)

	Users (n = 520)	Non-users (n = 1948)	test
Age (years)	54.6 \pm 2.8	55.8 \pm 2.9	1.3 NS
Body mass index (kg/m ²)	25.7 \pm 3.1	26.3 \pm 3.5	4.0***
Alcohol consumption (ml/wk)	166 \pm 286	204 \pm 304	2.7*
Education (years)			13.8**
≤ 7 years	3 (0.6)	15 (0.9)	
7 < . ≤ 11 years	316 (60.8)	1324 (68.0)	
11 < . < 15 years	116 (22.3)	392 (20.1)	
≥ 15 years	85 (16.3)	215 (11.0)	
Marital status			2.4 NS
couple	434 (83.5)	1678 (86.1)	
single	86 (16.5)	270 (13.9)	
Professional activity			13.9**
active	479 (92.1)	1679 (86.2)	
sick leave	8 (1.5)	46 (2.4)	
retired	8 (1.5)	39 (2.0)	
inactive	25 (4.9)	184 (9.4)	
Smoking status			18.1***
non-smoker	208 (40.0)	652 (33.5)	
ex-smoker	186 (35.8)	646 (33.2)	
current smoker	126 (24.2)	649 (33.3)	
Personal history of surgery	11 (2.1)	31 (1.6)	0.7 NS
Personal history of disease	190 (36.5)	681 (35.0)	0.5 NS
Vigorous Physical activity	94 (18.1)	225 (11.6)	15.5***
Leisure sport activity	447 (86.0)	1554 (78.3)	10.2***

Analysis by Chi-square or by Student's t-test: NS, not significant; * $p < 0.01$; ** $p < 0.005$; *** $p < 0.001$.

Table III: characteristics of male vitamin users in France and Northern Ireland. Results are expressed as means \pm SD or as number of subjects (percentage)

	France (n = 1161)	Northern Ireland (n = 520)	test
Age (years)	54.6 \pm 2.8	55.6 \pm 2.8	1.1 NS
Body mass index (kg/m ²)	25.9 \pm 3.0	25.7 \pm 3.1	1.2 NS
Alcohol consumption (ml/wk)	273 \pm 252	166 \pm 286	7.3***
Smoking status			36.8***
non-smoker	298 (25.7)	208 (40.0)	
ex-smoker	552 (47.5)	186 (35.8)	
current smoker	311 (26.8)	126 (24.2)	
Personal history of surgery	30 (2.6)	11 (2.1)	0.3 NS
Personal history of disease	671 (57.8)	190 (36.5)	65.0***
Vigorous Physical activity	431 (37.1)	94 (18.1)	60.7***
Leisure sport activity	967 (83.4)	447 (86.0)	1.9 NS

Analysis by Chi-square or by Student's t-test: NS, not significant; * $p < 0.01$; ** $p < 0.005$; *** $p < 0.001$.

Table IV: prevalence, awareness, and treatment rates for hypertension and dyslipidaemia among vitamin users in France and Northern Ireland. Results are expressed as number of subjects (percentage). The percentages of subjects aware for hypertension or dyslipidaemia are based on the number of hypertensive and dyslipidaemic subjects, respectively. The percentages of subjects treated for hypertension or dyslipidaemia are based on the number of aware subjects

	France (n = 1161)	Northern Ireland (n = 520)	test
Hypertension prevalence	265 (22.8)	105 (20.2)	1.5 NS
awareness	156 (58.9)	62 (59.0)	0.1 NS
dietary treatment	37 (23.7)	33 (53.2)	17.7***
drug treatment	117 (75.0)	42 (67.7)	1.2 NS
Dyslipidaemia prevalence	354 (30.5)	182 (35.0)	3.4 NS
awareness	280 (79.1)	57 (31.3)	117.5***
dietary treatment	160 (57.1)	44 (77.2)	8.0**
drug treatment	157 (56.1)	8 (14.0)	33.5***

Analysis by Chi-square test: NS, not significant; * $p < 0.01$; ** $p < 0.005$; *** $p < 0.001$.

and smoking (vitamin users relative to non-users: OR = 2.84, $p < 0.01$ and OR = 1.63, $p < 0.05$ for dietary treatment of hypertension and dyslipidaemia, respectively).

Characteristics of vitamin supplement users between countries: Vitamin supplement users in Northern Ireland had a lower consumption of alcohol, smoked less, had less past history of disease and physical activity than their French counterparts (Table III). Adjusting for age, body mass index, number of years in school and smoking status did not change the results (not shown). The frequency of dietary treatment for hypertension and dyslipidaemia was higher among Northern Irish vitamin users than among French users. Finally Northern Irish users had a lower frequency of awareness and medical treatment of dyslipidaemia than their French counterparts (Table IV), and those differences remained after multivariate adjustment for age, body mass index, educational level and tobacco smoking (Northern Ireland relative to France: OR = 0.13, $p < 0.001$ and OR = 0.10, $p < 0.01$ for awareness and treatment of dyslipidaemia, respectively).

Discussion

Little is known about the frequency of vitamin supplement use and of the characteristics of vitamin supplement users in France and Northern Ireland. In this study, the frequencies of vitamin supplement use were significantly lower in France than in Northern Ireland in males aged 50–59 years. Still, the observed frequencies in both countries were low compared to the results of other studies conducted in the USA [18, 24, 30], Canada [31], Australia [32] or the UK [11, 20], but comparable to those found in

Finland [33] and the Netherlands [19]. The differences between our findings in Northern Ireland and those from the other studies conducted in the UK might be partly explained by the younger age of the subjects in our sample, since vitamin supplement use is usually higher in older people [20].

In both countries, vitamin supplement use increased with educational level. Those findings are in agreement with other studies [34, 35], indicating that more educated subjects tend to consume more vitamin supplements than less well-educated subjects, probably as a preventive measure against disease, fatigue or stress [11, 12, 23, 36].

In France, vitamin supplement users reported a higher frequency of disease than non-users. Those findings are in agreement with other studies [17, 24] and indicate, at least in France, that vitamin supplement use remains linked to a popular conception of disease prevention. Still, the frequency of regular daily users of vitamin supplements was much lower in France than in Northern Ireland. Since the motivations for vitamin use were not asked in this study, the reasons for this lower frequency of daily use in France can only be speculated. A likely explanation is that French subjects use vitamin supplements as an acute treatment, whereas Northern Irish subjects use vitamin supplements like a preventive treatment. Notwithstanding, further studies are needed to assess this point. Also, in France, vitamin supplement use was related to a lower prevalence of hypertension. Although this might be attributable to other characteristics of the vitamin supplement users (for instance, younger age and lower body mass index), it is still possible that vitamin supplementation may decrease the prevalence of hypertension in a population at low risk for myocardial infarction, as suggested previously [3]. Again, further studies are necessary to assess this issue.

In Northern Ireland, vitamin supplement users were leaner and reported less smoking, a lower alcohol intake, and more dietary treatment of hypertension and dyslipidaemia than non-users. Those findings are in agreement with those of other studies [33–35] and indicate that in Northern Ireland, vitamin supplement use is associated with a healthier life-style and to a better acceptance of dietary interventions in cardiovascular prevention. Such behavior was less marked in France, where no differences were found between vitamin supplement users and non-users regarding smoking status and total alcohol consumption. Still, the lower body mass index of French vitamin supplement users might be partly explained by a higher frequency of overall dietary interventions in this group (data not shown). When the characteristics of vitamin supplement users were compared, subjects from Northern Ireland had a healthier lifestyle than those from France. Of particular interest was the finding that Northern Irish vitamin supplement users had significantly higher levels of dietary intervention directed against hypertension and dyslipidaemia, whereas French subjects had higher levels of hypolipidaemia drug treatment. Those findings can be explained either by a lower level of dietary intervention by French general practitioners, or by a lower compliance of French subjects to dietary intervention. Finally, the higher level of awareness and drug treatment among French subjects is consistent with previous findings from our group [37].

Several limitations of this study must be acknowledged. First, it included only volunteer men of a narrow age range. Since responders tend to be healthier than non-responders, it is possible that the prevalence of vitamin supplement use and of awareness of hypertension and dyslipidaemia may be overestimated in our study. Nevertheless, as indicated previously, the awareness levels observed for France are in agreement with data obtained in representative population samples by our group. Thus, it is unlikely that the observed prevalence of vitamin supplement use in France is grossly biased. Second, the vitamins consumed could not be adequately assessed in this study; since vitamin supplements differ between countries, it is thus possible that the types as well as the amounts of vitamin consumed may be different between France and Northern Ireland. Regarding France, the ongoing analysis of the data from the last MONICA survey in France might provide some clues to this point.

In summary, our results indicate that about one fifth of middle-aged men in France and Northern Ireland use vitamin supplementation and that in Northern Ireland, vitamin supplement use is associated with a healthier life-style and to dietary measures against hypertension and dyslipidaemia.

Acknowledgements

We thank the following organizations which allowed the recruitment of the PRIME subjects: the Health screening centers organized by the Social Security of Lille (Institut Pasteur), Strasbourg, Toulouse and Tourcoing; Occupational Medicine Services of Haute-Garonne, the Urban Community of Strasbourg, the Association Inter-entreprises des Services Médicaux du Travail de Lille et environs, the Comité pour le Développement de la Médecine du Travail; the Mutuelle Générale des PTT du Bas-Rhin; the laboratoire d'Analyses de l'Institut de Chimie Biologique de la Faculté de Médecine de Strasbourg.

The PRIME Study

The PRIME Study is organized under an agreement between INSERM and the Merck, Sharp and Dohme-Chibret laboratory, with the following participating Laboratories:

- The Strasbourg MONICA Project, Department of Epidemiology and Public Health, Faculty of Medicine, Strasbourg, France (D. Arveiler, B. Haas)
- The Toulouse MONICA Project, INSERM U518, Purpan Faculty of Medicine, Toulouse, France (J. Ferrétes, JB. Ruidavets)
- The Lille MONICA Project, INSERM U508, Lille, France (P. Amouyel, M. Montaye)
- The Department of Epidemiology, The Queen's University of Belfast, Belfast, Northern Ireland (A. Evans, J. Yarnell)
- The Department of Atherosclerosis, SERLIA-INSERM U325, Lille, France (G. Luc, JM. Bard)
- The Laboratory of Haematology, La Timone Hospital, Marseille, France (I. Juhan-Vague)
- The Laboratory of Endocrinology, INSERM U326, Toulouse, France (B. Perret)
- The Vitamin Research Unit, The University of Berne, Berne, Switzerland (F. Gey)
- The Trace Element Laboratory, Department of Medicine, The Queen's University of Belfast, Belfast, Northern Ireland (D. McMaster)
- The DNA Bank, Service Commun no 7 INSERM, Paris, France (F. Cambien)
- The Coordinating Center, INSERM U258, Hôpital Paul Brousse, Villejuif, France (P. Ducimetière, PY. Scarabin, A. Bingham).

References

- Rimm, E. B., Stampfer, M. J., Ascherio, A., Giovannucci, E., Colditz, G. A. and Willett, W. C. (1993) Vitamin E consumption and the risk of coronary heart disease in men. *N. Engl. J. Med.* 328, 1450-1456.
- Meyer, F., Bairati, I. and Dagenais, G. R. (1996) Lower ischemic heart disease incidence and mortality among vitamin supplement users. *Can. J. Cardiol.* 12, 930-934.
- Mark, S. D., Wang, W., Fraumeni, Jr. J. F., Taylor, P. R., Wang, G. Q., Guo, W., Dawsey, S. M., Li B. and Blot, W. J. (1996) Lowered risks of hypertension and cerebrovascular disease after vitamin/mineral supplementation: the Linxian Nutrition Intervention Trial. *Am. J. Epidemiol.* 143, 658-664.
- Kushi, L. H., Folsom, A. R., Prineas, R. J., Mink, P. J., Wu, Y. and Bostick R. M. (1996) Dietary antioxidant vitamins and death from coronary heart disease in postmenopausal women. *N. Engl. J. Med.* 334, 1156-1162.
- Mark, S. D., Wang, W., Fraumeni, Jr. J. F., Li, J. Y., Taylor, P. R., Wang, G. Q., Dawsey, S. M., Li, B. and Blot, W. J. (1998) Do nutritional supplements lower the risk of stroke or hypertension? *Epidemiology* 9, 9-15.
- Kim, I., Williamson, D. F., Byers, T. and Koplan, J. P. (1993) Vitamin and mineral supplement use and mortality in a US cohort. *Am. J. Public Health* 83, 546-550.
- Hennekens, C. H., Buring, J. E., Manson, J. E., Stampfer, M., Rosner, B., Cook, N. R., Belanger, C., LaMotte, F., Gaziano, T. A., Ridker, P. M., Willett, W. and Peto, R. (1996) Lack of effect of long-term supplementation with beta carotene on the incidence of malignant neoplasms and cardiovascular disease. *N. Engl. J. Med.* 334, 1145-1149.
- Rapola, J. M., Virtamo, J., Ripatti, S., Huttunen, J. K., Alhaves, D., Taylor, P. R. and Heinonen, O. P. (1997) Randomised trial of α -tocopherol and β -carotene supplements on incidence of major coronary events in men with previous myocardial infarction. *Lancet* 349, 1715-1720.
- Read, M., Schutz, H. G., Bendel, R., Bhalla, V., Harrill, I., Mitchell, M. E., Sheehan, E. T. and Sandel, B. R. (1985) Attitudinal and demographic correlates of food supplementation practices. *J. Am. Diet. Assoc.* 85, 855-857.
- McIntosh, W. A., Kubena, K. S., Walker, J., Smith, D. and Landmann, W. A. (1990) The relationship between beliefs about nutrition and dietary practices of the elderly. *J. Am. Diet. Assoc.* 90, 671-676.
- Sobal, J. and Daly, M. P. (1990) Vitamin/mineral supplement use among general practice patients in the United Kingdom. *Fam. Pract.* 7, 181-183.
- Yong, M. B. (1990) Vitamin use and beliefs among students at a Malaysian university. *J. R. Soc. Health* 110, 132-134.
- Gey, K. F. (1995) Ten-year retrospective on the antioxidant hypothesis of atherosclerosis: threshold of plasma levels of antioxidant micronutrients related to minimum cardiovascular risk. *J. Nutr. Biochem.* 6, 206-236.
- Gey, K. F. (1998) Vitamins E plus C, and interacting nutrients required for optimal health. A critical and constructive review of epidemiology and supplementation data regarding cardiovascular disease and cancer. *Biofactors* 7, 113-174.
- Hodis, H. N., Mack, W. J., Labree, L., Cashin-Hemphill, L., Sevastian, A., Johnson, R. and Azen, S. P. (1995) Serial coronary angiographic evidence that antioxidant vitamin intake reduces progression of coronary artery atherosclerosis. *JAMA* 273, 1849-1854.
- Stephens, N. G., Parsons, A., Schofield, P. M., Kelly, F., Cheeseman, K., Mitchinson, M. J. and Brown, M. J. (1996) Randomised controlled trial of vitamin E in patients with coronary disease: Cambridge Heart Antioxidant Study (CHAOS). *Lancet* 347, 781-786.
- Worley, A. and Crawford, D. (1984) Australian dietary supplementation practices. Health and dietary supplements. *Med. J. Aust.* 140, 579-583.
- Medeiros, D. M., Bock, M. A., Ortiz, M., Raab, C., Read, M., Schutz, H. G., Sheehan, E. T. and Williams, D. K. (1989) Vitamin and mineral supplementation practices of adults in seven western states. *J. Am. Diet. Assoc.* 89, 383-386.
- Dorant, E., van den Brandt, P. A., Hamstra, A. M., Feenstra, M. H., Goldbohm, R. A., Hermus, R. J. and Sturmans, F. (1993) The use of vitamins, minerals and other dietary supplements in The Netherlands. *Int. J. Vitam. Nutr. Res.* 63, 4-10.
- Daly, M. P. and Sobal, J. (1990) Vitamin/mineral supplement use by geriatric outpatients in the United Kingdom. *J. Nutr. Elder* 10, 55-64.
- Kato, I., Nomura, A. M., Stemmermann, G. N. and Ohno, P. H. (1992) Vitamin supplement use and its correlates among elderly Japanese men residing on Oahu, HI. *Public Health* 107, 712-717.
- Houston, D. K., Johnson, M. A., Daniel, T. D. and Poon, L. W. (1997) Health and dietary characteristics of supplement users in an elderly population. *Int. J. Vitam. Nutr. Res.* 67, 183-191.
- Schutz, H. G., Read, M., Bendel, R., Bhalla, V. S., Harrill, I., Monagle, J. E., Sheehan, E. T. and Sandel, B. R. (1982) Food supplement usage in seven Western states. *Am. J. Clin. Nutr.* 36, 897-901.
- Bender, M. M., Levy, A. S., Schucker, R. E. and Yelley, E. A. (1992) Trends in prevalence and magnitude of vitamin and mineral supplement usage and correlation with health status. *J. Am. Diet. Assoc.* 92, 1096-1101.
- Hartz, S. C., Oradovec, C. L., McGandy, R. B., Russell, R. M., Jacob, R. A., Sahyoun, N., Peters, H., Abrams, D., Scura, L. A. and Whinston-Perry, R. A. (1988) Nutrient supplement use by healthy elderly. *J. Am. Coll. Nutr.* 7, 119-128.
- Rougeteau, A., Person, O. and Rougeteau G. (1987) Retinol, beta-carotene and alpha-tocopherol status in a French population of healthy subjects. *Int. J. Vitam. Nutr. Res.* 57, 31-35.
- Herberg, S., Preziosi, P., Galan, P., Devanlay, M., Keller, H., Bougeois, C., Portier de Courcy, G. and Cherouvier, F. (1994) Vitamin status of a healthy French population: dietary intakes and biochemical markers. *Int. J. Vitam. Nutr. Res.* 64, 220-232.
- De Carvalho, M. J., Guillaud, J. C., Moreau, D., Boggio, V. and Fuchs, F. (1996) Vitamin status of healthy subjects in Burgundy (France). *Ann. Nutr. Metab.* 40, 24-51.

29. Wood, D., De Backer, G., Faergeman, O., Graham, I., Mann-
cia, G., Pyörälä, K. and together with members of the Task
Force (1998) Prevention of coronary heart disease in clinical
practice. Recommendations of the Second Joint Task
Force of European and other Societies on Coronary Preven-
tion. *Eur. Heart J.* 19, 1434–1503.
30. Subar, A. F. and Block, G. (1990) Use of vitamin and min-
eral supplements: demographics and amounts of nutrients
consumed. The 1987 Health Interview Survey. *Am. J. Epi-
demiol.* 132, 1091–1101.
31. Payette, H. and Gra-Donald, K. (1991) Do vitamin and min-
eral supplements improve the dietary intake of elderly Cana-
dians? *Can. J. Public Health* 82, 58–60.
32. Horwath, C. C. and Worsley, A. (1989) Dietary supplement
use in a randomly selected group of elderly Australians. Re-
sults from a large nutrition and health survey. *J. Am. Geri-
atr. Soc.* 37, 689–696.
33. Klaukka, T., Riska, E. and Kimmel, U. M. (1985) Use of vi-
tamin supplements in Finland. *Eur. J. Clin. Pharmacol.* 29,
355–361.
34. Koplan, J. P., Annest, J. L., Layde, P. M. and Rubin, G. L.
(1986) Nutrient intake and supplementation in the United
States (NHANES II). *Am. J. Public Health* 76, 287–289.
35. Slesinski, M. J., Subar, A. F. and Kahle, L. L. (1996) Dietary
intake of fat, fiber and other nutrients is related to the use of
vitamin and mineral supplements in the United States: the
1992 National Health Interview Study. *J. Nutr.* 126,
3001–3008.
36. Nelson, M. V. and Bailie, G. (1990) A survey of pharmacists
recommendations for food supplements in the USA and UK.
J. Clin. Pharm. Ther. 15, 131–139.
37. Marques-Vidal, P., Evans, A. E., Cambou, J. P., Arveiler, D.,
Luc, D., Bingham, A. and Cambien, F. (1997) Awareness and
control of hypertension and hypercholesterolaemia in France
and Northern Ireland. *Q. J. Med.* 90, 341–345.

Jean Ferrières

INSERM U518

Faculté de Médecine Toulouse-Purpan
Département d'Epidémiologie

37, Allées Jules Guesde
F-31073 Toulouse cedex
France