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ORIGINAL COMMUNICATION

Gender, age, socio-demographic and lifestyle factors associated with major dietary patterns in the Spanish Project SUN (Seguimiento Universidad de Navarra)

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Objective: To ascertain the major dietary patterns in the cohort 'SUN' and to assess the association of several sociodemographic (including age and gender) and lifestyle variables with the adherence to these dietary patterns.
Design: This study is a cross-sectional analysis of 3847 subjects (1587 men and 2260 women) belonging to a prospective cohort study based on self-reported questionnaires. A factor analysis based on 30 predefined food groups was conducted to ascertain the major dietary patterns in the cohort. Multiple regression models were fitted to assess the relationship between several sociodemographic and lifestyle variables and the adherence to these dietary patterns (measured using two scores with observed values ranging from -3.2 to $+4.6$ for the Western pattern and -3.1 to $+5.5$ for the Mediterranean pattern).
Results: Two major dietary patterns were found. The first pattern was labelled as a 'Western' dietary pattern and the other as a 'Spanish-Mediterranean' dietary pattern. Younger subjects were more likely to follow a 'Western' dietary pattern; the coefficient representing the change for every 10 y increase in age was $b=-0.24$ ($P<0.001$) for men and $b=-0.12$ ($P<0.001$) for women. More physically active subjects were less likely to follow a 'Western' dietary pattern and more likely to follow a 'Spanish-Mediterranean' dietary pattern.
Conclusions: An association between a higher level of physical activity during leisure time and adherence to a 'Spanish-Mediterranean' diet was apparent. However, the profile of being a young, sedentary and single male was identified as the most likely to exhibit a departure from the traditional 'Spanish-Mediterranean' diet and follow a 'Western' dietary pattern.
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Introduction

Diet plays an important role in determining the leading causes of morbidity and mortality in developed countries (coronary heart disease (CHD), stroke, diabetes and cancer; American Heart Asociation, 2000; WHO, 1997). Specific components of the diet have drawn increasing attention in recent years (Gandini *et al*, 2000; Liu *et al*, 2000; Oomen *et al*, 2000). Nevertheless, although the role of individual nutri-

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ents and food items in these diseases has been largely studied, nutrients and foods are consumed in combination. There can exist antagonistic and synergistic effects among nutrients and food items. An overall dietary pattern might have a greater effect on health than one food or nutrient (Jacques & Tucker, 2001). Thus, there is an increasing interest in investigating the relationship between the adherence to different dietary patterns and the occurrence of CHD, stroke, diabetes or cancer (Hu *et al*, 2000; Williams *et al*, 2000; Slattery *et al*, 1998).

For example, the Mediterranean diet has been postulated as a protective factor against CHD and related disorders (Kris-Etherton *et al*, 2001; Ryan *et al*, 2000; Joshipura *et al*, 1999). In the same way, it has been hypothesized that Mediterranean diet reduces the risk of several types of cancer (Trichopoulou *et al*, 2000; Martín-Moreno *et al*, 1994). Nevertheless, there is limited epidemiological information about the beneficial effects of this pattern. Moreover, the factors associated with the adherence to this pattern have been scarcely evaluated.

The SUN ('Seguimiento Universidad de Navarra') project is a prospective Mediterranean cohort study designed to establish the association between several sociodemographic, nutritional and lifestyle characteristics and the occurrence of different diseases.

In this study we attempted to empirically identify the eating patterns of the participants. Moreover, we examined the factors associated with the adherence to the assessed eating patterns.

Methods

A cross-sectional analysis of the SUN prospective cohort study was done. The SUN study is based on self-reported questionnaires sent to alumni of the University of Navarre every 2 y (Sánchez-Villegas *et al*, 2001,2002; Martínez-González *et al*, 2002). The project was designed in collaboration with the Harvard School of Public Health during 1998 and the methodology is similar to that used in the large American cohorts, Nurses' Health Study (Liu *et al*, 2000) and Health Professionals' Follow-up Study (Hu *et al*, 2000).

Dietary and non-dietary exposures were measured by two mailed questionnaires. One of them was a self-administered questionnaire related to lifestyle and the other one was a semi-quantitative food frequency questionnaire previously validated in Spain (Martín-Moreno *et al*, 1993).

Project feasibility was tested with a pilot study developed in two waves during 1999 (Sánchez-Villegas *et al*, 2002). Participant recruitment started in January 2000. The data set of the SUN Project incorporated 4259 participants up until March 2001. Recruitment is on-going as this is a dynamic cohort study.

Nutrient intake scores were computed using an *ad hoc* computer program specifically developed for this aim. A dietitian updated the nutrient data bank using the latest available information included in the food composition tables for Spain (Mataix, 1998; Moreiras, 1995). Nutrient scores were calculated as:

$$\text{frequency} \times \text{nutrient composition of a specified portion size}$$

where frequencies were measured in nine frequency categories (6+ per day/4–6 per day/2–3 per day/1 per day/5–6 per week/2–4 per week/1 per week/1–3 per month/never or almost never) for each food item.

Subjects who reported excessively high or low values for total food or energy intake (less than 800 kcal/day in men and 600 kcal/day in women or more than 4200 kcal/day in men and 3500 kcal/day in women) or those with missing values in other variables were excluded from the analysis ($n = 412$). Finally, 3847 subjects (1587 men and 2260 women) were included to assess the adherence to different dietary patterns.

The 136 food items included in the semi-quantitative food frequency questionnaire were grouped in 30 predefined food groups (Table 1). A factor analysis (principal components) based on the 30 predefined food groups was conducted to assess the major dietary patterns in the cohort (Utts, 1996). Only the factors having latent roots or eigenvalues greater than 1 and easily interpreted were considered in the analysis. The factors were not rotated.

We used the factor loading matrix to extract the weights (factor loadings) for each food group. Observing these weights, we named the two major factors as dietary patterns. After considering the weights of the food groups we labelled the first factor as 'Western' dietary pattern (WDP) and the second factor as 'Spanish-Mediterranean' dietary pattern (SMDP; Table 2). These variables were calculated as linear combinations of the standardized values of the 30 predefined food groups using the factor scores found in the factor analysis as coefficients. The minimum and maximum observed values for these variables were -3.2 to $+4.6$ for the adherence to the WDP and -3.1 to $+5.5$ for adherence to the SMDP. They were normally distributed.

The distribution of sociodemographic and lifestyle characteristics of the sample was described according to quintiles of the adherence to WDP and SMDP. Multivariate analyses were fitted separately for men and women to assess the relationship between several sociodemographic or lifestyle variables and the adherence to the dietary patterns.

The sociodemographic characteristics used in the analysis were: age at the time of recruitment, body mass index (BMI; weight (in kg)/height^2 (in m)), smoking status and number of cigarettes smoked, marital status (married or not), having obtained a health-related degree (medicine, nursing, or pharmacy), history of several diseases (diabetes, obesity, hypercholesterolaemia and hypertension), physical activity during leisure time (METs-h/week), and years of education. (We considered the age of 14 as the first year of education because mandatory schooling lasts until 14 y in Spain.)

Table 1 Food groupings used in the dietary pattern analysis

Food groups	*Items*
Animal fats	Butter, lard
Carbonated drinks	Coca-cola, other carbonated beverages, low-energy carbonated beverages
Cereals	White bread, cold breakfast cereal, rice, pasta
Chocolate and sweets	Cakes, chocolate, almonds-candies ('turrón', 'mazapán', 'mantecados'), cookies
Eggs	Eggs
Fast food	Hamburger, pizza, hot-dog
Fish and other seafood	White fish, dark-meat fish, salad or smoked fish, clams, mussels, shrimp, squid
French fries	French fries
Fruit juices	Orange juice, other fruit juices, canned juices
Fruits	Citrus, banana, pear, strawberry, peach, cherry, fig, melon, watermelon, grapes, kiwi, mango, avocado, other tinned fruits
High-fat dairy products	Whole milk, condensed milk, cream, milk shake, yogurt, custard, cheese, crème caramel, ice-cream, other dairy products
Home-made pastries	Home-made pastries
Legumes	Lentils, chickpeas, beans, peas
Low-fat dairy products	Skim or low-fat milk, skim yogurt, white cheese
Meat products	Cooked ham, Parma ham, mortadella, salami, foie-gras, spicy pork sausage, bacon, cured meats and cold cuts ('chorizo')
Nuts	Walnuts, peanuts, almonds, hazelnuts, date, raisins
Olive oil	Olive oil
Other alcoholic drinks	Beer, liquors
Other fats	Peanut butter, sesame seed oil
Other vegetable oils and fats	Margarine, sunflower oil, corn oil
Potatoes	Cooked or roast
Poultry	Chicken, turkey
Processed meals	Croquettes, tuna/meat pasty, powdered soup
Processed pastries	Madeleines, doughnuts, croissants, other industrial bakery
Red meats	Beef, pork, lamb, rabbit, liver
Sauces	Mayonnaise, tomato sauce, ketchup
Sugars	Sugar, honey, jam, marmalade
Vegetables	Carrots, swiss chard, cauliflower, lettuce, tomatoes, green beans, eggplant, peppers, asparragus, spinach, other fresh vegetables
Wholewheat bread	Wholewheat bread
Wine	Red wine, white wine

Table 2 Factor loading matrix for the major factors (dietary patterns) identified by using food consumption data[a]

	Factor 1 ('Western' dietary pattern; WDP)	*Factor 2 ('Spanish-Mediterranean' dietary pattern; SMDP)*
Fast-food	0.54	
French fries	0.49	
High-fat dairy products	0.46	
Processed meals	0.44	
Red meats	0.43	
Low-fat dairy products	−0.42	
Sauces	0.39	
Meat products	0.38	0.38
Processed pastries	0.38	
Eggs	0.36	
Wholewheat bread	−0.33	
Vegetables		0.63
Fish and other seafood		0.52
Fruit		0.49
Poultry		0.37
Olive oil		0.32
Legumes		0.31
Nuts		0.30
Potatoes		0.30

[a]Component matrix.
Absolute values <0.30 were not listed in the table.
The first factor explained 8.51% of the total variance and the second factor explained 6.34% of the total variance.

Smoking status was classified into ex-smokers and current smokers. Current smokers were categorized into three groups (<10 cigarettes a day, 10–20 cigarettes/day, >20 cigarettes/day).

To quantify the volume of activity, an activity metabolic equivalent (MET) index was computed by assigning a multiple of resting metabolic rate (MET score) to each activity. Metabolic equivalents represent the ratio of energy expended during each specific activity to resting metabolic rate and they are independent of body weight (Ainsworth *et al*, 2000). Time spent in each of the activities was multiplied by the MET score specific to each activity, and then summed over all activities obtaining a value of overall weekly METs-h.

Results

The general characteristics of the diet of our participants were 18.3% of total energy intake from protein, 35.1% from fat (16.4% of total energy from monounsaturated fatty acids) and 44.6% from carbohydrates (data not shown), with only minor differences between men and women.

When we entered food item consumption data for the 30 predefined food groups into the factor analysis procedure, eigenvalues indicated two major dietary patterns and eight

minor dietary patterns. For each of the two major patterns, foods with a very high factor loading (set at 0.30 or greater) are shown in Table 2. The first dietary pattern could typify a WDP. This pattern was characterized by a high consumption of fast food (factor loading = 0.54), french fries (0.49), high-fat dairy products (0.46), processed meals (0.44), red meats (0.43), sauces (0.39), meat products (0.38), processed pastries (0.38) and eggs (0.36) and by a low consumption of low-fat dairy products (− 0.42) and wholewheat bread (− 0.33).

The second dietary pattern was labelled a 'Spanish-Mediterranean' dietary pattern (SMDP) because it was characterized by a high consumption of vegetables (0.63),

Table 3 Baseline characteristics according to quintiles of 'Western' dietary pattern in the SUN Project

	Quintile of 'Western' dietary pattern		
	Q1	*Q2–Q4*	*Q5*
Gender (% men)	21.1	37.9	63.9
Married (%)	48.1	49.4	35.3
Health-related profession (%)	39.5	39.2	31.7
Current smoking status (%)			
Non-smokers	47.9	48.7	55.3
Ex-smokers	30.5	25.6	18.0
< 10 cigarettes/day	13.4	16.0	12.3
10–20 cigarettes/day	6.9	7.8	9.3
> 20 cigarettes/day	1.4	1.9	5.1
History of diseases (%)			
Diabetes	2.2	0.8	0.5
Hypertension	6.5	3.2	4.8
Hypercholesterolaemia	22.6	12.5	8.5
Cardiovascular disease	1.0	0.5	0.8
Obesity (BMI $\geq 30\,kg/m^2$)	7.9	5.8	4.5
Age (y) (mean (s.d.))	38.6 (12.0)	36.5 (10.0)	34.1 (9.1)
Educational level (y) (mean (s.d.))	9.0 (1.9)	9.3 (2.0)	9.4 (2.0)
Body mass index (kg/m^2) (mean (s.d.))	22.7 (3.2)	23.1 (3.3)	23.3 (3.2)
Physical activity during leisure time (METs-h/week) (mean (s.d.))	23.1 (25.1)	17.9 (20.0)	19.7 (23.9)

s.d., standard deviation.
BMI, body mass index (kg/m^2).
METs, metabolic equivalents.

Table 4 Baseline characteristics according to quintiles of 'Spanish-Mediterranean' dietary pattern in the SUN Project

	Quintile of Spanish-Mediterranean dietary pattern		
	Q1	*Q2–Q4*	*Q5*
Gender (% men)	43.3	39.5	38.9
Married (%)	46.8	46.0	46.2
Health-related profession (%)	31.6	39.2	39.0
Current smoking status (%)			
Non-smokers	48.2	50.1	51.0
Ex-smokers	25.3	25.0	24.2
< 10 cigarettes/day	17.0	13.7	15.9
10–20 cigarettes/day	6.9	8.6	7.0
> 20 cigarettes/day	2.6	2.6	1.9
History of diseases(%)			
Diabetes	1.0	0.7	1.7
Hypertension	4.0	3.6	6.2
Hypercholesterolaemia	14.5	13.1	14.6
Cardiovascular disease	1.0	0.6	0.7
Obesity (BMI $\geq 30\,kg/m^2$)	4.5	5.7	8.0
Age (y) (mean (s.d.))	36.7 (9.5)	36.2 (10.2)	36.6 (11.5)
Educational level (y) (mean (s.d.))	9.6 (2.1)	9.2 (2.0)	9.1 (1.9)
Body mass index (kg/m^2) (mean (s.d.))	23.0 (3.4)	23.0 (3.1)	23.1 (3.4)
Physical activity during leisure time (METs-h/week) (mean (s.d.))	15.7 (19.9)	18.2 (19.7)	26.1 (28.2)

s.d., standard deviation.
BMI, body mass index (kg/m^2).
METs, metabolic equivalents.

fish (0.52), fruit (0.49), poultry (0.37), olive oil (0.32), legumes (0.31), nuts (0.30) and potatoes (0.30).

The distribution of the baseline characteristics of the sample according to the quintiles of the WDP and the SMDP is shown in Tables 3 and 4, respectively. Men were more likely to follow the WDP (64% of men in the upper quintile *vs* 21.1% in the lowest). Younger people, those who smoked more than 20 cigarettes a day and those with a higher BMI were more likely to follow a WDP. However, married subjects, participants who had a health-related degree or those with a previous history of diabetes, hypertension, obesity or hypercholesterolaemia were less likely to be adherent to a WDP. Participants more physically active and those with a previous history of obesity were more likely to follow a SMDP. People with more years of education were less likely to comply with this dietary pattern.

Multivariable analysis of sociodemographic and lifestyle variables associated with the adherence to the two patterns were conducted using multiple regression models. We fitted separated models for men and women. Regression coefficients and confidence intervals (95%) for the factors associated with the adherence to a WDP are shown in Tables 5.

In men, the adherence was higher among younger participants with a significant linear trend for every 10 y increase of age ($b = -0.24$; $P < 0.001$). Independently of age, married and more active men were less likely to be adherent to a WDP ($b = -0.32$; $P < 0.001$ for married men and $b = -0.03$ for every 10-MET-h; $P < 0.001$). Those with a history of diabetes or hypercholesterolaemia where less likely to follow this pattern. Likewise, smokers of more than 20 cigarettes a day (as compared with non-smokers) presented a higher adherence to the WDP (the regression coefficient was $+0.73$, $P < 0.001$).

Among women, the higher the educational level (measured as years of education) the greater the adherence to a WDP ($b = +0.03$ for each year of education; $P = 0.01$). Older, more active women, ex-smokers and those with a history of obesity or hypercholesterolaemia had a lower adherence to a WDP than younger, more sedentary, non-smoking women or those not previously diagnosed with these diseases.

Factors associated with the adherence to a SMDP were also analysed (Table 6). The most important factor positively associated with the adherence to a SMDP was physical activity during leisure time ($P < 0.001$ for both men and women). Furthermore, men who had a health-related degree exhibited a greater adherence to an SMDP ($b = +0.19$; $P = 0.01$). On the other hand, having more years of education was associated with a lower adherence to a SMDP in men ($b = -0.05$; $P < 0.001$) and in women ($b = -0.03$; $P = 0.01$).

Discussion

Two major dietary patterns were found in the analysis of the first 4259 subjects belonging to the SUN Project, the WDP and the SMDP.

There is an increasing interest in the study of dietary patterns and their effects on health in contrast to the study of isolated nutrients or food items. Nube *et al* (1987) found that a higher survival was associated with adherence to a dietary pattern based on 10 food items and named it the 'Prudent pattern'. Likewise, a healthy dietary pattern based on the World Health Organization guidelines was associated with a mortality reduction in the Seven Countries Study (Huijbregts *et al*, 1997). Other outcomes apart from either total mortality or survival have also been associated with

Table 5 Factors associated with the adherence to a 'Western' dietary pattern[a]

	Men			*Women*		
	b	*CI (95%)*	P	*b*	*CI (95%)*	P
Age (increment of 10 y)	−0.24	−0.29 to −0.17	<0.001	−0.12	−0.17 to −0.07	<0.001
Married	−0.32	−0.44 to −0.21	<0.001	−0.03	−0.13 to +0.06	0.54
Total years of education	−0.01	−0.03 to +0.02	0.61	+0.03	+0.01 to +0.05	0.01
Health-related profession	+0.08	−0.04 to +0.20	0.20	+0.01	−0.07 to +0.09	0.73
Physical activity during leisure time (increment of 10 METs-h/week)	−0.03	−0.05 to −0.01	0.01	−0.07	−0.09 to −0.05	<0.001
Current smoking status						
Non-smokers	0 (ref)			0 (ref)		
Ex-smokers	−0.09	−0.22 to +0.05	0.21	−0.14	−0.25 to −0.04	0.01
<10 cigarettes/day	+0.04	−0.13 to +0.21	0.67	+0.001	−0.11 to +0.11	0.97
10–20 cigarettes/day	+0.09	−0.09 to +0.27	0.33	−0.10	−0.26 to +0.06	0.24
>20 cigarettes/day	+0.73	+0.44 to +1.02	<0.001	+0.05	−0.25 to +0.36	0.73
History of diseases (%):						
Diabetes	−0.63	−1.25 to −0.01	0.05	−0.04	−0.42 to +0.34	0.82
Hypertension	−0.02	−0.23 to +0.19	0.83	+0.08	−0.21 to +0.37	0.58
Hypercholesterolaemia	−0.22	−0.36 to −0.08	0.002	−0.34	−0.47 to −0.20	<0.001
Obesity (BMI ≥ 30 kg/m^2)	−0.19	−0.40 to +0.02	0.08	−0.23	−0.41 to −0.05	0.01

[a]Adjusted for all variables shown in the table, body mass index and previous diagnosis of cardiovascular disease. The minimum and maximum values for the variable used as outcome (Western pattern) were −3.2 and +4.6.
b = regression coefficient (a positive coefficient implies a higher adherence to the pattern). CI, confidence interval. METs, metabolic equivalents. BMI, body mass index (kg/m^2).

Table 6 Factors associated with the adherence to a 'Spanish-Mediterranean' dietary pattern[a]

	Men			*Women*		
	b	*CI (95%)*	P	*b*	*CI (95%)*	P
Age (increment of 10 y)	+0.03	−0.03 to +0.09	0.28	−0.01	−0.06 to +0.04	0.68
Married	−0.01	−0.13 to +0.11	0.86	+0.02	−0.08 to +0.12	0.74
Educational level (y)	−0.05	−0.08 to −0.02	<0.001	−0.03	−0.06 to −0.01	0.01
Health-related profession	+0.19	+0.06 to +0.32	0.004	+0.05	−0.04 to +0.13	0.31
Physical activity during leisure time (increment of 10 METs-h/week)	+0.07	+0.04 to +0.09	<0.001	+0.09	+0.07 to +0.11	<0.001
Current smoking status						
Non-smokers	0 (ref)			0 (ref)		
Ex-smokers	−0.12	−0.26 to +0.02	0.09	+0.01	−0.10 to +0.12	0.89
<10 cigarettes/day	0.00	−0.18 to +0.18	0.98	−0.02	−0.14 to +0.10	0.46
10–20 cigarettes/day	+0.01	−0.18 to +0.20	0.93	+0.07	−0.11 to +0.24	0.46
>20 cigarettes/day	−0.09	−0.40 to +0.21	0.55	−0.18	−0.51 to +0.15	0.29
History of diseases (%)						
Diabetes	−0.11	−0.75 to +0.54	0.74	+0.27	−0.14 to +0.69	0.20
Hypertension	+0.20	−0.02 to +0.43	0.07	0.00	−0.31 to +0.32	0.98
Hypercholesterolaemia	+0.08	−0.07 to +0.23	0.29	+0.05	−0.01 to +0.20	0.50
Obesity (BMI ≥ 30 kg/m^2)	+0.23	−0.01 to +0.45	0.04	+0.18	−0.02 to +0.38	0.07

[a]Adjusted for all variables shown in the table, body mass index and previous diagnosis of cardiovascular disease. The minimum and maximum values for the variable used as outcome (Spanish Mediterranean pattern) were −3.1 and +5.5.
b = regression coefficient (a positive coefficient implies a higher adherence to the pattern). CI, confidence interval. METs, metabolic equivalents. BMI, body mass index (kg/m^2).

dietary patterns, including CHD (Hu *et al*, 2000; Kant & Thompson, 1997), stroke (Kant & Thompson, 1997), hypertension (Sacks *et al*, 2001), diabetes (Williams *et al*, 2000) or cancer (Chen *et al*, 2002; Erickson, 2002; Slattery *et al*, 1998). Hu *et al* (2000) found an inverse association between a 'Prudent' diet (rich in vegetables, legumes, fruit, poultry and fish) and the risk of CHD, while an increased risk of CHD was associated with following a 'Western' pattern (rich in red and processed meat, refined grains, sweets, french fries and high-fat dairy products). In the same way, Slattery *et al* (1998) established six different dietary patterns where the 'Western' and 'Prudent' patterns were the most important factors. The first was rich in red and processed meats, fast food, eggs, margarine, potatoes and refined grains. The second one was rich in fresh and tinned fruit, salads, vegetables, tomatoes and carrots. The 'Western' pattern was associated with a higher risk of colon cancer whereas the 'Prudent' pattern showed an inverse association.

The elements included in our empirically identified patterns are somewhat similar to those reported in these investigations. In our study, the diet which emphasized fast-food, french fries, high-fat dairy products, processed meals and red meats was labelled as a 'Western' dietary pattern. On the other hand, the pattern rich in vegetables, fish, fruit, poultry, olive oil, legumes and nuts was labelled a 'Spanish-Mediterranean' dietary pattern. The items of the second identified pattern are coincidental with the well-known characteristics of the traditional Spanish-Mediterranean diet.

The Mediterranean diet has been considered as an important protective factor against some diseases like CHD or cancer (Kris-Etherton *et al*, 2001; Ryan *et al*, 2000; Trichopoulou *et al*, 2000; Joshipura *et al*, 1999; Martín-Moreno *et al*, 1994). The occurrence of these diseases is lower in Mediterranean countries as compared with other geographical regions such as Japan or USA (Willett, 1994). Moreover, this pattern has been established within Mediterranean societies for a long time (Trichopoulou & Lagiou, 1997). That is why we considered it worth trying to empirically identify to what extent this pattern is still present in our cohort and we assessed the social and behavioural characteristics associated with it.

We also found that some characteristics of our participants were different according to the dietary pattern type. Younger participants were more likely to follow the WDP. It is believed that younger people in Spain and in other Mediterranean countries seem to be more likely to adopt 'American-type' diets which frequently contain food items like hamburgers, pizzas or ketchup sauce, although the empirical evidence supporting this view is scarce. The magnitude of this change towards American-type patterns as subjects are younger can be estimated using the regression coefficients (*b*) shown in Table 5 (−0.24 for men and −0.12 for women) together with the range of observed values (−3.2 to +4.6). Thus, for every 10 y increase we found a 3% change among men and a 1.5% change among women. Therefore, our study provides support for the hypothesis of a departure in Spain from the traditional SMDP (Rodriguez-Artalejo *et al*, 1996; Serra-Majem *et al*, 1993), mainly among younger individuals.

Similarly, single, widowed and divorced men tended to choose this type of food item more frequently than married ones, who seem more likely to maintain the traditional dietary habits in Spain.

Our results provide support to a dangerous departure of the SMDP among highly educated people in Spain. This departure might be reaching other sectors of the Spanish

population because highly educated people commonly exert a exemplary role on less educated people, who might change their habits to imitate them. We acknowledge that a likely explanation could be that more educated subjects are more likely to work in highly demanding activities which very often may also condition their diet. These work-related pressures may lead them to depart from the traditional SMDP. However, in any case, the habits of highly educated strata of the population are more likely to be eventually transferred to the whole population, and thus a special interest exists in studying their diet and lifestyles.

Physical activity during leisure time was positively associated with adherence to an SMDP, whereas it was negatively associated with adherence to a WDP. These associations were highly significant and of important magnitude for both men and women. Similar results have been reported in other studies (Kromhout *et al*, 2001; Williams *et al*, 2000; Slattery *et al*, 1998; Schroll *et al*, 1996; Raitakari *et al*, 1995) regarding the association between an active lifestyle and a healthier diet, but many of these studies did not specifically assess Mediterranean populations.

Women who were ex-smokers had lower adherence to a WDP. Ex-smoker women are probably more likely to make positive decisions concerning their health. A more health-conscious and responsible profile is usually found among ex-smokers (Boyle *et al*, 2000).

Finally, having a history of obesity among women and a history of hypercholesterolaemia among both men and women was associated with a lower adherence to a WDP. The diagnosis of several diseases might have led to changes in dietary habits and to adopt some healthier and more protective diets.

In conclusion, we found two major dietary patterns in this baseline assessment of our cohort. However, the interpretation of our findings needs to consider that we did not use a random procedure to select our sample. Moreover, our participants had a high educational level. Therefore, they cannot be considered as a representative sample for Spain or for a specific region within Spain in the strict statistical sense. This is the usual case in most cohort studies, for example in some other cohorts based on alumni (Lee *et al*, 1995), nurses or blood donors. This cohort study has been designed to assess the association between dietary characteristics (such as adherence to a specific dietary pattern) and other factors, including in the future the occurrence of several diseases. The important issue for this goal is to ensure that the population under study will allow a fair degree of between-person variability in nutrient intake, but not necessarily to select a 'representative' sample (Rothman & Greenland, 1998).

Some sociodemographic characteristics and lifestyles were associated with these two patterns. An association between healthier lifestyles, above all physical activity, and the adherence to a SMDP was of special interest. This association leads us to think that some of the postulated benefits of SMDP can be also due to an overall healthier lifestyle. On the other hand, a profile of being a young male, sedentary, single and with more years of education was associated with a WDP or an 'American-type' dietary pattern.

If our results are confirmed in future studies, these data should be used to design creative intervention strategies specifically tailored to the target groups that we have identified as more likely to depart from a healthier dietary pattern. Similarly, some behaviours such as a sedentary lifestyle or smoking should be simultaneously addressed because of the dangerous clustering of these behaviours with an unhealthy dietary pattern.

It could be paradoxical that, in a country such as Spain, an American pattern is becoming more and more popular (especially among younger people) when the trend in the USA is to adopt healthier dietary patterns with some similar characteristics of the traditional Mediterranean diet, emphasizing vegetable, fruit and legume consumption (WHO, 1993). Specific educational interventions are probably needed to maintain the traditional Mediterranean dietary pattern considered protective against some diseases. However prevention at the societal level is often ineffective when the target is a total social entity (Susser & Susser, 1996a,b) and it is important to tailor interventions to specific population groups. Our results suggest that the younger, sedentary, more educated and single subjects are more likely to give up the traditional Mediterranean pattern in Spain.

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