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# The effect of clinical characteristics and dietary habits on the relationship between education status and 5-year incidence of cardiovascular disease: the ATTICA study

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**Abstract** *Objective* The aim of this work was to investigate whether clinical characteristics and dietary habits influence the association between education status and 5-year incidence of cardiovascular disease (CVD). *Methods* From 2001 to 2002, 1,514 men and 1,528 women (>18 year) without known CVD were enrolled. In 2006, the 5-year follow-up was performed (31% participants were lost to follow-up). Development of fatal or non-fatal CVD (coronary heart disease, acute coronary syndromes, stroke, or other CVD) was defined according to WHO-ICD-10 criteria. Education status was measured in years of school, while baseline dietary habits were assessed through a semi-quantitative food-frequency questionnaire (EPIC-Greek). The Mediterranean-Diet-Score was applied to assess overall adherence to this pattern using scores of 11 food-variables and alcohol, according to the principles of the Mediterranean-diet. *Results* The 5-year incidence of CVD was 108 (11.0%) cases in men and 62 (6.1%) cases in women ($P < 0.001$); 32 (1.6%) of these events were fatal (21 in men). People in the low education group had significantly higher prevalence of hypertension, diabetes, and dyslipidemias, were more likely to be sedentary and smokers, compared to high group. Moreover, compared to high, people in low education group had less healthy dietary habits, as assessed using the diet score ($P < 0.001$). Multi-adjusted analysis revealed that low education was positively associated with 5-year incidence of CVD, after adjusting for age and sex (HR = 1.64; 95%CI 1.05–2.55); however this association lost its significance when clinical characteristics and dietary habits were taken into account (HR = 1.31; 95%CI 0.63–2.74). *Conclusions* Low education seems to increase CVD risk, an observation that was partially explained by baseline clinical characteristics and unhealthy dietary choices of people belonging into this group.

**Key words** cardiovascular diseases – diet – education – socio-economic – risk factors

## Introduction

In most Western countries standardized morbidity and mortality are inversely related to socio-economic status (SES) [7, 12, 18, 22]. That is extended to chronic diseases, such as cardiovascular disease (CVD) and cancer [10, 39]. These associations have been mainly attributed to differences in the prevalence of various risk factors between social classes

EJN 720

[9, 21, 23]. In general, less educated and lower income groups tended to have increased smoking habits, being sedentary and consume a less healthy diet; all these facts may lead to the development of various metabolic disorders, and consequently CVD [1, 3, 6, 24, 30, 34]. Therefore, SES has been suggested as a very important determinant of a person's health status. In order to define SES of people three indicators have been most often used in the literature, occupation, education and income. However, the relatively weak correlation of these three indices in developed countries suggest that although these tools measure the same concept, they cover different aspects of the socio-economic structure, contributing individually to the relationship between SES and disease [8, 38]. One of these determinants, the education status, seems to have several advantages since it can be obtained from any person independently of age or working circumstances, has high reliability and validity, is generally stable after early adulthood, and it is easily reported [3, 6, 8, 19, 38]. The association between education status and dietary habits has been studied in several studies around the world, and in the Mediterranean basin, too [31]. However, whether dietary choices may explain, at least in part, the association of CVD risk with social determinant, like education status, has rarely been evaluated.

During the past 30 years, Greece has experienced marked, but uneven socio-economic development. Although the education status improved, the lifestyle of people worsened. Stable, age-old dietary habits (such as increased intake if fruit, vegetables, whole grain cereals, low-fat dairy products, moderate intake of fish and alcohol and rare intake of meat and products) as well as high habitual physical activity, have gradually given way to "Western"-type diets and a more sedentary lifestyle [4, 14]. All these, combined with limited awareness on health and dietary issues, and adverse dietary practices, lead to high rates of obesity and other cardio-metabolic disorders [4, 14, 15]. Regarding the relation between SES and CVD there is limited data available, in Greece. In particular, it has been shown in the CARDIO2000 case-control study [28] that there was an inverse association between education status and the prevalence of coronary heart disease, but could not be adequately explained. Furthermore, the ATTICA study, during the baseline examination revealed an inverse association between education status and several clinical and biochemical markers related to CVD. These cross-sectional observations were mainly explained by the adoption of an unhealthy lifestyle (including increased smoking habits, physical inactivity, unhealthy dietary habits), and non-compliance to medication, by individuals of low education [26].

However, at which extend the SES, and particularly education level, is associated with the development of future CVD events has rarely been investigated in Greece, and in most of the European countries. Moreover, the role dietary habits on the aforementioned relationship have never been evaluated. Thus, the purpose of this work was to investigate whether various clinical characteristics and dietary habits may explain the relationship between education status and 5-year incidence of CVD, in a sample of CVD–free men and women from Greece.

## Methods

### Study design

The "ATTICA" study started as a nutrition and health survey of the Greek population (during 2001–2002), and in 2006 the first follow-up was performed the first follow-up. The sampling has been carried out in the province of Attica, which includes 78% urban and 22% rural areas. The procedure anticipated enrolling only one participant per household; it was random, multistage and based on the age (5 age-groups), gender (males, females) distribution of the Attica region (27 stages were used according to the census of 2001). People with any clinical evidence of CVD or living in institutions were excluded from the sampling. During the enrolment period, 4,056 inhabitants from the above area were selected; of them, 3,042 agreed to participate (75% participation rate), 1,514 of the participants were men and 1,528 were women. All participants interviewed by trained personnel (cardiologists, general practitioners, dieticians and nurses) who used a standard questionnaire. The study has been approved by the ethics committee of the Department of Cardiology of Athens Medical School.

### Baseline measurements

The baseline evaluation included information about several socio-demographic characteristics (age, gender, mean annual income and years of school), personal and family history of hypertension, hypercholesterolemia and diabetes, family history of CVD, dietary and other lifestyle habits, such as smoking status, and physical activity. For analysis reasons the participants' educational level was also classified into three groups: "Low" education participants reported comprehensive school, trade school or technical institute/school as their basic education (≤9 years of school), but had not attended high school; "Medium" education participants had studied at, or completed senior high school or technical college (9–14 years of school), but had not attained a university education; "High" education participants had studied at, or graduated from, university or college (>14 years of school).

The evaluation of the nutritional habits was based on a detailed, reproducible, validated semi-quantitative food-frequency questionnaire (the Greek-EPIC questionnaire [16]) that was kindly provided by the Department of Epidemiology of Athens Medical School. All participants were asked to report the average intake (per week or day) of 156 food items or beverages that they usually consumed during the last 12 months. Then, the frequency of consumption was quantified approximately in terms of the number of times a month a food was consumed. Any type of alcohol consumption was measured in wineglasses (100 ml) and quantified by ethanol intake (in g per day). In order to describe overall diet composite scores were used, which are necessary for the evaluation of epidemiological associations. Thus, a modified version of the MedDietScore was used (range 0–55, [27]) that is based on the rationale of the Mediterranean dietary pyramid [35]. Particularly, for the consumption of items presumed to be close to this pattern (i.e. those suggested on daily basis or more than four servings per week) scores 0–5 were assigned when a participant reported no consumption to daily consumption, respectively. On the other hand, for the consumption of foods presumed to be away from this diet (like meat and meat products) the opposite scores were assigned (i.e. 0 when a participant reported almost daily consumption to 5 for rare or no consumption). In the modified score used in this work, potatoes consumption score 5 was given for the recommended intake of 3–4 servings per week [35], score 4 was assigned for 1–2 servings per week, and scores 3 to 0 were given for rare, or frequent, very frequent and daily consumption, respectively. Regarding alcohol intake score 5 was assigned for consumption of less than 3 wineglasses per day, score 0 for consumption of none or more than 7 wineglasses per day and scores 4–1 for consumption of 3, 4, 5, and 6 wineglasses per day. Higher values of this score indicates better adherence to the Mediterranean diet. Smokers were defined as those who were smoking at least one cigarette per day during the past year or had recently stopped smoking (during a year); the rest of the participants were defined as non-current smokers. For the ascertainment of physical activity status the international physical activity questionnaire (IPAQ) was used [5], as an index of weekly energy expenditure using frequency (times per week), duration (in minutes per time) and intensity of sports or other habits related to physical activity (in expended calories per time). Participants at baseline examination were classified as inactive, minimally active and HEPA active (health enhancing physical activity; a high active category), based on the following criteria: inactive, which is the lowest physical activity level, was classified an individual when no criteria were met to classify him or her in any of the other two categories; minimally active, which is the classification for sufficiently active, when any of the following three criteria were met: (a) Three or more days of vigorous activity of at least 20 min per day, (b) Five or more days of moderate-intensity activity or walking of at least 30 min per day, or (c) 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving of at least 600 MET-min/week; and HEPA active when any of the following criteria were met: (a) vigorous-intensity activity on at least 3 days achieving a minimum of at least 1,500 MET-min/week, or (b) Seven or more days of any combination of walking, moderate-intensity or vigorous intensity activity achieving a minimum of at least 3,000 MET-min/week. Participants were instructed to report only episodes of activities of at least 10 min, since this is the minimum required to achieve health benefit. Body mass index (BMI) was measured as weight (in kilograms) divided by standing height (in meters squared). Obesity was defined as BMI greater than 29.9 $Kg/m^2$. Arterial blood pressure (three recordings) was measured at the end of the physical examination with subject in sitting position. All participants were at least 30 min at rest. Participants whose average blood pressure levels were greater or equal to 140/90 mmHg or were under antihypertensive medication were classified as having hypertension. Blood samples were collected from the antecubital vein between 8 and 10 a.m., in a sitting position after 12 h of fasting and alcohol abstinence. Total serum cholesterol was measured using chromatographic enzymic method in a Technicon automatic analyser RA-1000 (Dade Behring, Marburg, Germany). Hypercholesterolemia was defined as total cholesterol levels greater than 200 mg/dl or the use of lipids lowering agents. Blood glucose levels (mg/dl) were measured with a Beckman Glucose Analyzer (Beckman Instruments, Fullerton, CA, USA). Diabetes mellitus (type 2) was defined according to the American Diabetes Association diagnostic criteria (i.e., blood glucose levels >125 mg/dl classified participants as having diabetes). The intra and inter-assay coefficients of variation of cholesterol or glucose levels did not exceed 7%. Further details about the aims and procedures of the ATTICA epidemiological study may be found elsewhere [26, 29].

## Five-year follow-up

During 2006, the ATTICA study's investigators performed the 5-year follow-up. In order to participate in the follow-up examination all participants were contacted through telephone calls (80% of the participants) or in their home places when the telephone number was not available. Of the 3,042 initially enrolled participants, 1,012 men and 1,035 women were found alive at the time of the follow-up, while 32 (2.1%) men and 22 (1.4%) women died during the 5-year period. The rest of the participants (i.e., 941) were lost to follow-up (69% participation rate). Of the individuals that they did not participate in the re-examination, 75% were not found because of missing or wrong addresses and telephone numbers, and the rest denied being re-examined. No significant differences were observed between those who were lost to follow-up and the rest of the participants regarding sex ($P = 0.99$), age ($P = 0.78$), years of school ($P = 0.67$), presence of hypertension ($P = 0.12$), diabetes ($P = 0.27$), hypercholesterolemia ($P = 0.12$) and dietary habits, as evaluated by the modified MedDietScore ($P = 0.28$). Thus, taking into account those who were lost to follow-up, data from 1,996 participants were analyzed in this work.

Death from any cause was ascertained through death certificates from regional register offices. In the rest of the participants Study's investigators performed a detailed clinical evaluation in the rest of the participants' using accurate medical records that included information about: (a) development of coronary heart disease (including myocardial infarction, angina pectoris, other identified forms of ischemia - WHO-ICD coding 410–414.9, 427.2, 427.6-, heart failure of different types, and chronic arrhythmias - WHO-ICD coding 400.0–404.9, 427.0–427.5, 427.9-) or development of stroke (WHO-ICD coding 430–438), (b) development of hypertension, hypercholesterolemia, and diabetes, (c) assessment of body weight and height, and (d) lifestyle habits, including physical activity and smoking status, as well as consumption of various food groups and beverages.

## Statistical analysis

The time to CVD event was recorded on annual basis. Incidence rates were calculated as the ratio of new cases by the number of people participated in the follow-up. Continuous variables are presented as mean values ± standard deviation and categorical variables are presented as frequencies. Associations between categorical variables were tested using the $\chi^2$ test. Comparisons of mean values of normally distributed variables between those who developed a CVD event and the rest of the participants were performed using the Analysis of Variance.

The hazard ratios of developing a CVD event during the 5-year period, according to the participants' education status and other baseline characteristics, were estimated using Cox Proportional hazards models. Diet was included in all analyses as a continuous variable using the MedDietScore described above. Interactions between education status and diet score, as well as other covariates were tested in all models, and when they were significant, remained in the model. Deviance residuals were used to evaluate model's goodness-of-fit. All reported $P$-values are based on two-sided tests and compared to a significance level of 5%. However, due to multiple comparisons the Bonferroni rule was applied to take into account the inflation of type I error. SPSS version 14 (Statistical Package for Social Sciences, SPSS Inc, Chicago, IL, USA.) software was used for all the statistical calculations.

# Results

## Distribution of baseline demographic, lifestyle and clinical characteristics by education status

The distribution of various socio-demographic, clinical characteristics is shown in Table 1. As we can see people in the low education group were older than the medium and high education group. Physical activity distribution showed that the most active group was the high education ($P < 0.001$), but overall these values are considered low as it seems that a large proportion of the population remain physically inactive. It is interesting that the low education group had the lowest prevalence of smoking with the high education group being next, whereas the highest percentage of smokers was observed in the medium education group ($P < 0.001$). Regarding the established CVD risk factors, such as obesity, hypertension, type 2 diabetes mellitus and

**Table 1** Baseline demographic, lifestyle and clinical characteristics of the ATTICA study participants, by education status

| Baseline factors | Education status group[a] | | | |
|---|---|---|---|---|
| | Low | Medium | High | $P$[b] |
| Age (years) | 56 ± 13 | 45 ± 14* | 41 ± 12* | <0.001 |
| Male gender (%) | 47 | 49 | 52 | 0.129 |
| Smokers (%) | 36 | 49* | 40* | <0.001 |
| Physical activity (%) | 36 | 37 | 45* | <0.001 |
| Body mass index (kg/m$^2$) | 27.9 ± 4.7 | 26.4 ± 4.5* | 25.4 ± 4.2* | <0.001 |
| Obesity (%) | 28 | 19* | 13* | <0.001 |
| Hypertension (%) | 41 | 30* | 24* | <0.001 |
| Diabetes mellitus (%) | 16 | 7* | 3* | <0.001 |
| Hypercholesterolemia (%) | 53 | 35* | 33* | <0.001 |

*$P < 0.01$ for the comparisons between high, or medium vs. low education group

[a]Low education: <9 years of school, medium education ($n = 560$), 9–14 years of school ($n = 1,391$) and high education: >14 years of school ($n = 1,084$). Descriptive statistics are expressed as mean ± SD, or frequencies

[b]$P$ for trend between all education groups

hypercholesterolemia, between-group analysis showed that in general the low education group is more likely to share the above risk factors than people in the high education group, with medium education standing in the middle in a sequential order.

## Baseline dietary characteristics by education

The baseline weekly consumption of selected food groups and other dietary choices, by education status, is illustrated in Table 2. Compared to the dietary guidelines of the traditional Mediterranean diet pyramid [35] it was observed that the consumption of red meat and its products was much higher than the recommended intake (i.e., 1 serving per week), with the low education group consuming more red meat than the medium and high education groups ($P < 0.001$). Differences were also found in the consumption of potatoes ($P < 0.001$), alcohol intake ($P < 0.001$), use of olive oil in daily cooking ($P < 0.001$) and use of butter ($P < 0.001$), with the high education group consuming less potatoes, alcohol and butter and using more often olive oil than the low and medium groups. Finally, higher adherence to the traditional Mediterranean diet (as evaluated by the modified MedDietScore) was observed in the high education group compared to the medium and low education groups ($P < 0.001$).

## Incidence of CVD events after 5-year of follow up by education status

The CVD event rate was 170 events per 9,787 person years of observation (11.0% in men and 6.1% in women, $P$ for gender difference $< 0.001$, as well as 20.4% in low, 6.4% on medium and 5.0% in high education status, $P < 0.001$); 32 of these events were fatal (21 men), thus the 5-year CVD death rate was 1.6%. Causes of death were: myocardial infarction (25 cases), stroke (6 cases) and other CVD (1 case). Gender–specific analysis revealed that the highest proportion of CVD events occurred in the low education group, for both men ($P < 0.001$) and women ($P < 0.001$). Finally, age distribution of CVD events showed that there was a significant difference in the 35–65 year group, with the low education group having a higher incidence of CVD events compared to the medium and high education groups ($P < 0.01$).

To further evaluate the association between education status and 5-year incidence of CVD we applied survival analysis (Table 3). Low education was positively associated with 5-year incidence of CVD, after adjusting for age and gender (Table 3, model 1). However, the association between education status and CVD risk lost its significance when clinical and lifestyle variables were taken into account. In particular, when BMI, smoking, hypertension, hypercholesterolemia, diabetes, and physical activity were taken into account, no significant association was observed between education status and incidence of CVD, while the effect of education on CVD risk was slightly reduced ($P$ for the change in the hazard ratios between models 1 and 2 = 0.19). Moreover, the relationship between education and CVD risk also lost its significance when baseline dietary habits of the participants were taken into account, while the effect of education on CVD risk was significantly reduced ($P$ for the change in the hazard ratios between models 1

**Table 2** Baseline dietary habits (servings/week unless stated otherwise) by education status of the ATTICA study participants

| Foods or food groups consumed at baseline evaluation | Education status group[a] | | | |
|---|---|---|---|---|
| | Low | Medium | High | $P^b$ |
| Red meat and products | 5.5 ± 2.9 | 4.9 ± 2.6* | 4.4 ± 2.0* | <0.001 |
| Poultry | 1.21 ± 0.8 | 1.32 ± 0.84 | 1.32 ± 0.79 | 0.41 |
| Fish | 1.98 ± 1.42 | 2.12 ± 1.48 | 2.25 ± 1.45 | 0.14 |
| Legumes | 5.5 ± 3.6 | 5.1 ± 2.6 | 4.9 ± 2.8 | 0.13 |
| Dairy products | 11.7 ± 5.9 | 11.6 ± 5.3 | 11.6 ± 4.5 | 0.96 |
| Fruits | 27.9 ± 15.8 | 26.3 ± 13.9 | 25.8 ± 12.9 | 0.34 |
| Vegetables | 35.3 ± 17.3 | 32.9 ± 14.3 | 34.9 ± 13.8 | 0.08 |
| Potatoes | 13.1 ± 8.7 | 12.3 ± 7.3 | 10.9 ± 5.9 | 0.001 |
| Cereals | 55.5 ± 24.4 | 52.7 ± 17.8 | 51.4 ± 16.6 | 0.10 |
| Sweets | 4.7 ± 2.8 | 4.9 ± 2.4 | 4.9 ± 2.2 | 0.65 |
| Coffee (ml/day) | 112.6 ± 136.2 | 116.6 ± 129.1 | 117.5 ± 121.0 | 0.76 |
| Ethanol intake (g/day) | 22.1 ± 18.7 | 15.4 ± 16.4* | 13.1 ± 14.9* | <0.001 |
| Use of olive oil in cooking and meals (%) | 90 | 82 | 96 | <0.001 |
| Use of butter in cooking and meals (%) | 43 | 59* | 19* | <0.001 |
| *Modified*-MedDietScore (0–55) | 23.5 ± 6.5 | 25.4 ± 7.3* | 25.9 ± 6.3* | <0.001 |

*$P < 0.01$ for the comparisons between high, medium vs. low education group
[a]Low education: <9 years of school, medium education ($n$ = 560), 9–14 years of school ($n$ = 1,391) and high education: >14 years of school ($n$ = 1,084). Descriptive statistics are expressed as mean ± SD, or frequencies
[b]$P$ for trend between all education groups

**Table 3** Results from Cox proportional hazards models regarding the association between education status and CVD events after 5 years of follow-up, adjusted for various variables

| | Hazard ratio | 95% Confidence interval | Model adjusted for |
|---|---|---|---|
| Model 1: education group | | | |
| Low | 1.64 | 1.05–2.55 | Age, gender |
| Medium | 1.04 | 0.69–1.59 | |
| High | 1.00 | – | |
| Model 2: education group | | | |
| Low | 1.42 | 0.89–2.26 | Age, gender, BMI, smoking, hypertension, hypercholesterolemia, diabetes, and physical activity status |
| Medium | 0.86 | 0.55–1.35 | |
| High | 1.00 | – | |
| Change from model 1: $x^2$ = 18.27, df = 6, $P$ = 0.006 | | | |
| Model 3: education group | | | |
| Low | 1.64 | 0.85–3.16 | Age, gender, BMI, smoking, hypertension, hypercholesterolemia, diabetes, physical activity status and alcohol intake |
| Medium | 0.70 | 0.37–1.33 | |
| High | 1.00 | – | |
| Change from model 2: $x^2$ = 2.527, df = 1, $P$ = 0.112 | | | |
| Model 4: education group | | | |
| Low | 1.31 | 0.63–2.74 | Age, gender, BMI, smoking, hypertension, hypercholesterolemia, diabetes, physical activity status and modified-meddietscore |
| Medium | 0.78 | 0.41–1.51 | |
| High | 1.00 | – | |
| Change from model 2: $x^2$ = 4.07, df = 1, $P$ = 0.044 | | | |

and 4 = 0.028). Additionally, the interaction term between MedDietScore and education status on the investigated outcome, was highly significant ($P < 0.001$). Finally, the inclusion of alcohol intake (Table 3, model 3) did not influence the association between education and CVD risk.

## Discussion

In this work, we studied the association between education status, a social class determinant, and 5-year incidence of CVD events, in a representative sample of the Greek population. Overall there was a higher incidence of CVD events in the low education group compared to the medium and high education groups. However, this finding was mainly explained by the reported "unhealthy" baseline dietary habits, as well as the higher prevalence of classical CVD risk factors of the medium and low education groups compared to high group.

Studies have shown that lower levels of education are associated, mainly, with CVD risk factors, as well as with cardiovascular morbidity and mortality [9, 10, 13, 21, 26, 28]. A large part of our sample follows a sedentary lifestyle, with the low education group being less active than the high education group. This observation may, partially, explain the unadjusted inverse relationship between education status and CVD events. This is of great importance since several studies suggest that sedentary individuals have an increased risk of death compared to individuals who are physically active [32, 36]. Regarding the differences of various food group intakes, it was observed that the low education group consumed more potatoes than the medium and high education groups. This might be important as potatoes have a high glycemic index and they are rapidly converted to glucose after being consumed. Potato consumption has been found to be positively associated with the risk of type-2 diabetes in both men and women [11], and consequently could influence CVD risk. The higher intake might be explained by the fact that higher educated individuals tend to avoid foods that are considered as being more fattening or rich in energy, such as bread and other starchy foods. Regarding alcohol intake the low education group reported higher intake than the medium and high education groups, but overall the intake does not exceed the recommended, moderate, intake of 1–2 glasses per day. The association between alcohol intake and CVD is consistent in several studies and shows some protection from CVD at consumption levels of one to two drinks per day, but a sharp increase in CVD risk is associated with three or more drinks per day. It is generally concluded that alcohol, when consumed responsibly in most populations, is an important component of the Mediterranean diet and a component of a healthy lifestyle [2, 20, 25, 33, 37]. Overall dietary assessment using the modified MedDietScore showed that people in the higher education group had greater adherence to the traditional, healthy Mediterranean dietary pattern. Several studies in Europe have already underlined the beneficial role of this traditional dietary pattern on CVD mortality and morbidity [14, 20, 37]. The Mediterranean dietary pattern was also associated with reduced all-cause and cause-specific mortality in a recent study by Mitrou et al. [25] conducted in a US population. Finally, in another study by Knoops et al. [17] conducted in elderly European men and women adherence to a Mediterranean diet and healthful lifestyle was associated with a more than 50% lower rate of all-causes and cause-specific mortality. A finding of our analysis that may deserve further attention was that when dietary habits were included in the CVD risk prediction model (i.e., Table 3, model 3), the observed inverse relationship between education status and CVD risk lost its significance, and the effect size was reduced considerably. The latter may state a hypothesis for further research about the mediating effect of the diet component on the association between social status and health. This finding means that the increased CVD event rate observed in the low education group was attributed, at least in part, to the unhealthy dietary choices reported by the low and medium education groups at baseline examination. It is important to mention at this point that none of the participants at follow-up examination reported significant changes in their dietary habits during the follow-up period.

## Limitations

The present study has some limitations. One limitation, which is also observed in most nationwide population surveys, is that the poor are usually not well represented, because the homeless or unemployed are difficult to reach. Additionally, in nutritional studies that use self-reported data, social desirability reporting bias is possible in subjects with a higher educational level, who tend to be more aware of the characteristics of a healthy diet and have more knowledge about which food items are healthier. Thus, the latter may influence the generalization of the findings. Finally, the loss to follow-up was high (about 30%); however, no differences were observed between those participated in the follow-up and those lost in major clinical and lifestyle factors.

## Conclusion

Our results show that the increased 5-year event rate of CVD observed in low educated participants as compared to high, was, at least partially, attributed to various clinical characteristics and unhealthy dietary choices, which these people reported at baseline examination. The latter findings indicate that national strategies focused on lowering the burden of CVD through nutrition education and health promotion should focus their attention towards high risk social groups, such as people with low education status.

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