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Prevalence of risk factors for cardiovascular disease by socio-economic status among the elderly from Mediterranean islands: the MEDIS study

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Summary
Background: Socio-economic status (SES) has been associated with the prevalence and incidence of cardiovascular disease (CVD). The aim of this work was to investigate the association between SES and clinical and biochemical factors related to CVD, in a sample of elderly men and women.
Methods: During 2005—2007, 937 men and women (aged 65—100 years) from Cyprus ($n = 300$), Mitilini ($n = 142$), Samothraki ($n = 100$), Cephalonia ($n = 104$), Corfu ($n = 160$) and Crete ($n = 131$) islands, participated in the survey. CVD risk factors, i.e. hypertension, diabetes, hypercholesterolemia and obesity, as well as behavioural, lifestyle and dietary characteristics were assessed using face-to-face interviews and standard procedures.
Results: Multiple logistic regression analysis revealed that people in the lowest SES group, compared to highest were 2.14-times (95% CI 1.24—3.71) more likely to have four or more of the common CVD risk factors, i.e. smoking, physical inactivity, obesity, hypertension, diabetes and hypercholesterolemia, irrespective of age, sex, dietary habits and depression status. Moreover, an interaction was observed between SES and depression score ($p < 0.001$), suggesting that people in the lowest SES group and high depression score experience 4.5-times (95% CI 1.38—14.69) higher probabilities of having four or more CVD risk factors.

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Conclusions: An inverse relationship between SES and factors related to CVD risk exists among elderly people. Our findings underline the importance of focused preventive strategies, especially, among low SES people, in order to improve the quality of life among elderly individuals.

Introduction

Several studies have shown that the socio-economic status (SES), mainly determined from occupation, educational level and income, is related to mortality and morbidity from various chronic diseases [1—5]. It has been suggested that the most striking improvements in cardiovascular health have occurred among wealthier, better-educated people, while progress among groups with lower SES has lagged. In the beginning of the 20th century, results from observational studies suggested that cardiovascular disease (CVD) was originally more common in the upper SES, i.e. a ''disease of affluence'' [1]. This was attributed mainly to the increased prevalence of the common CVD risk factors in individuals with higher education and income. However, after the middle of the 20th century this gradually changed, especially in westernised countries, so that, currently, CVD is more common in the lower SES groups [4,5]. People with lower SES tend to adopt unhealthier behaviours, such as smoking, unhealthy dietary habits, and seem to have a worsened psychological profile and an increased prevalence of the common CVD risk factors, i.e. hypertension, hypercholesterolemia and diabetes. Moreover, some investigators have suggested that as the economic and cultural environments of developing countries become more modern or ''western'', so do the diets of their citizens [6—8]. However, the focus on SES as a risk factor of CVD is somewhat unsatisfying. SES describes the impact of the hierarchical arrangements on a broad set of behavioural and biological traits, which themselves are the more proximate mediators of risk. Therefore, the causal pathway itself requires more detailed explication before the SES measures can have explanatory power.

Greece was known for its low incidence of CVD among western populations, mainly due to the different lifestyle related behaviors, such as dietary habit [9]. However, during the past decades, the Greek population has experienced marked, but uneven socio-economic development. The progress of the modern Greek economy began in the early 20th century with the adoption of social and industrial legislation and the development of the first industrial companies [10]. Greece achieved high rates of growth from the 1950s through the early 1970s due to large foreign investments. Recent economic performance has also been satisfying. Principal sectors of the socio-economic development include tourism (accounting for about 70% of GDP in 2002), shipping, manufacturing and construction, as well as agricultural activities [10]. Moreover, during the third quarter of 2006, Greece experienced a significant increase in the economic growth rate as compared to the one of the previous year, i.e. 4.4% vs. 3.8%, which was also among the highest rates in the EU. Although the educational status improved, the lifestyle of people worsened and age-old dietary habits and habitual physical activity have gradually given way to ''Western''-type diets and a more sedentary lifestyle, with increased smoking habits [9]. According to several demographic studies, the developed world is ageing rapidly, since life expectancy has increased due to improving health care, better quality of life and control of various health threats [11]. Additionally, the expanding cohort of the elderly (aged 65+), as well as the ''oldest old'' (aged 80+) will impose a burden on society by testing the health care system as well as the social welfare policies [11]. Greece is one of the developed societies that face the ''problem'' of ageing, since the number of people belonging in the elderly or oldest old group increases faster than in any other age-group [12]. It has also been suggested that the ageing population and continuous immigration will put increasing pressure on healthcare resources in the near future [12]. In the context of the Mediterranean Islands (MEDIS) study, we sought to investigate whether SES is associated with several clinical and biochemical markers, related to CVD, in a sample of CVD-free elderly individuals from various Greek Islands and Cyprus. The MEDIS study [13] is a health and nutrition survey that aimed to evaluate bio-clinical, lifestyle, behavioral and dietary characteristics of elderly people living on Mediterranean Islands and who are without any clinical evidence of CVD in their medical history. Participants in the study are close to the limits of their life expectancy for their generation, without having any clinical symptoms of the most common health disorders, i.e. CVD or cancer. People living on

Greek Islands are supposed to be ''closer'' to the traditional ''Mediterranean way of living'' that Ancel Keys and his colleagues from the Seven Countries study revealed in the early 1970s [14]. Discrepancies in SES are not considered to have much influence on individual health status.

Methods

Participants

A random, population-based, multistage sampling method with three age-group: (65—74, 75—85, 85+) was used to select men (76 ± 7 years) and women (74 ± 7 years), from Cyprus Republic and Mitilini, Samothraki, Cephalonia, Crete and Corfu islands, in Greece. Individuals residing in assisted-living centers, as well as those with a clinical history of CVD were not included in the survey. The target sample size was 300 people from Cyprus and 150 from each of the other islands. Of the initially selected people, 437 men and 500 women ($n = 937$) agreed to participate (Cyprus, $n = 300$, Mitilini, $n = 142$, Samothraki, $n = 100$, Cephalonia, $n = 114$, Crete, $n = 131$ and Corfu, $n = 150$). Of these, 348 (37.1%) were living in rural areas of the islands. The participation rate varied from 75% to 83%. A group of health scientists including physicians, dietitians and nurses, with previous experience in field investigation collected all the required information, using a quantitative questionnaire and standard procedures.

The retrieved data were confidential, and the study followed ethical considerations provided by the World Medical Association (52nd WMA General Assembly, Edinburgh, Scotland, October 2000). Before the interview, participants were informed about the aims and procedures of the study, and signed an informed consent.

The final number of enrolled participants was a-priori decided through power analysis calculations in order to achieve statistical power >0.85 at the <0.05 probability level (p-value), for two-sided hypotheses regarding standardized differences between groups of study equal to 0.5 standard deviations.

Assessment of SES

Indices of SES assessed through years of education and mean annual income of the family (through self-reports and divided into four classes: low (<€7200), medium (€7200—11,999), high (€12,000—20,000) and very high (>€20,000)), during the last three years. At this point it should be noted that given that most of the elderly people who participated in our survey were pensioners, there was little benefit in the inclusion of occupation in the SES calculation. Regarding people in the family who were not working, we used the average family income, while for unemployed individuals we used the basic monthly allowance provided by the social service office. Since no accurate measure of SES exists in Greece, a special ''socio-economic'' index was developed in order to evaluate SES of the participants. It should be noted that the independent use of education level and financial status in multi-adjusted models would raise the issue of co-linearity that influences the robustness of the estimates of the models. Thus, the index was developed as follows: we multiplied the years of schooling in each individual with the classification of their annual income (range of the index: from 0 to 64). This index was normally distributed according to the Kolmogorov—Smirnov criterion. Then, we divided our sample into three groups (tertiles) according to this score, and we named 1st tertile (<4 score, $n = 312$) as ''low SES'', 2nd tertile as ''medium SES'' (4—10 score, $n = 311$) and 3rd tertile as ''high SES'' (>10 score, $n = 314$). This type of assessment of SES has already been reported in the literature [4].

Measurements

The retrieved information included basic demographic characteristics, such as age (in years), gender, living alone or with others, place of living, lifestyle, as well as various bio-clinical characteristics.

Daily smokers were defined as those participants who smoke at least one cigarette per day, non-daily smokers were defined as those who rarely smoked cigarettes. Former smokers (>12 months) were defined as those who previously smoked, but have not done so in a year or more. The remaining participants were defined as non-smokers. Exposure to environmental tobacco smoke (at workplace, home or restaurants) for more than 30 min per day defined people as passive smokers. Dietary habits were assessed through a semi-quantitative, validated (in our institution) food-frequency questionnaire. Weekly consumption of 15 food groups and beverages, i.e. meat and products, fish and fisheries, milk and other dairy, fruits, vegetables, greens and salads, legumes, cereals, coffee and tea and soft-drinks was assessed. Intake of various alcoholic beverages such as wine and beer was measured in terms of wine glasses adjusted for ethanol intake e.g., one 100 ml glass of

wine was considered to have 12% ethanol. To better evaluate overall dietary habits, a special diet score (MedDietScore) (range 0–55) was used to assess adherence to this traditional dietary pattern [15]. Higher values of this diet score indicate greater adherence to the Mediterranean diet.

Physical activity was evaluated using the shortened version of the self-reported, International Physical Activity Questionnaire (IPAQ) for the elderly [16]. Frequency (times per week), duration (minutes per time) and intensity of physical activity during sports, occupation and/or free-time activities were assessed. Participants who did not report any physical activity were defined as sedentary. In accordance with the standard IPAQ scoring procedures, physically active participants were classified into one of the following groups: upper tertile: ''vigorous'' physical activity (i.e. >2500 MET/min/week), middle tertile: ''moderate'' physical activity (i.e. 500–2500 MET/min/week), and lower tertile: ''sedentary'' (i.e. <500 MET/min/week). Symptoms of depression during the past month were measured using a shortened version of the self-report, geriatric depression scale (GDS) [17].

Furthermore, diabetes mellitus (Type 2) was determined by fasting plasma glucose tests and was analyzed in accordance with the American Diabetes Association diagnostic criteria. Fasting blood glucose levels greater than 125 mg/dl or use of special medication, indicated the presence of diabetes. Moreover, participants who had blood pressure levels $\geqslant$140/90 mmHg or used antihypertensive medications were classified as hypertensive. Fasting blood lipids levels were also recorded and hypercholesterolemia was defined as total serum cholesterol levels >200 mg/dl or the use of lipid-lowering agents. HDL-, LDL-cholesterol and triglycerides were also recorded. Weight and height were measured to attain body mass index (BMI) scores (kg/m^2). Obesity was defined as BMI > 29.9 kg/m^2. Waist circumference was also measured.

Data analyses

Continuous variables are presented as mean values ± standard deviation (SD), while categorical variables are presented as relative frequencies. Associations between categorical variables were tested by the calculation of a chi-squared test, while differences between SES groups and several biochemical, clinical and nutritional variables were tested by the use of Analysis of Variance (ANOVA) and Kruskal–Wallis test, for the normally distributed and the skewed dependent variables, respectively. Furthermore, multiple logistic regression models were used to evaluate the likelihood of having an increased number of the investigated CVD risk factors, i.e. smoking, physical inactivity, obesity, hypertension, diabetes and hypercholesterolemia as a function of SES (independent factor). The potential confounding effect of lifestyle variables, as well as the presence of any significant interactions between SES and the other investigated variables, was also tested. The Hosmer–Lemeshow criterion was used to evaluate goodness-of-fit. All reported p-values are based on two-sided tests and compared to a significance level of 5%. However, when multiple comparisons were made within a test, we used the Bonferroni correction in order to account for the increase in type I error. SPSS 14 software (SPSS Inc., Chicago, IL, USA) was used for all the statistical calculations.

Results

Distribution of demographic characteristics and lifestyle factors by SES

Regarding age distribution of demographic characteristics, there was a highly significant difference ($p = 0.002$) between SES groups (Table 1), with people in the low education group being significantly older than the medium and high education groups (75.8 ± 7.3, 74.6 ± 7.2 and 71.2 ± 7.4 years, respectively). Additionally, the majority of participants in the low SES group were women (65%), while the majority of participants in the medium SES group were men (63%). There was a relatively even distribution of men and women in the high SES group. Place of living (i.e. rural or urban) did not play any significant role in the distribution of sex ($p = 0.96$) in the investigated sample; however, people living in urban areas were more likely to be in the lower tertile of SES compared to those living in rural regions (68% vs. 51%, $p = 0.0001$). Place of living was therefore considered a potential confounder in the analyses.

Smoking was prevalent in all groups, with the low SES group exhibiting the lowest percentage and the high SES group exhibiting the highest. There was a significant association ($p < 0.0001$) between SES groups and the distribution of former smokers as the high SES group showed the highest proportion of former smokers and the low SES group the lowest. The distribution of physical activity showed that the high SES group compared

Table 1 Demographic and lifestyle characteristics of elderly men and women who participated in the MEDIS study, by SES

	Socio-economic status			*p*
	Low	Medium	High	
Age (years)	75.8 ± 7.3	74.6 ± 7.2	71.2 ± 7.4**	0.002
Sex (% male)	35	63**	52**	<0.0001
Living in rural areas (%)	51	6**	43	<0.0001
Living alone (%)	30	26	23	0.13
Smoking status				
Daily (%)	8	12	16	0.177
Former, >12 months (%)	22	34*	61**	<0.0001
Passive (%)	16	33**	9*	0.028
Physical activity (%)	34	39	65**	0.007
MedDietScore (range 0—55)	20.0 ± 3.3	22.0 ± 3.0*	21.9 ± 3.0*	0.002
Geriatric depression scale (0—15)	7.5 ± 3.6	6.5 ± 3.7*	6.4 ± 4.5*	0.004

Data are presented as mean ± (SD = standard deviation) or relative frequencies (%).
*P-values < 0.05 and **P-values < 0.01 between high, medium vs. low socio-economic groups, after correcting for multiple comparisons using the Bonferroni rule.

to the middle and low groups was the most active ($p = 0.007$).

Regarding dietary habits, it is evident from our analysis (Table 1) that people in middle or high SES class have better adherence to the traditional Mediterranean diet (i.e. higher diet score). However, the mean differences in the MedDietScore were small, and achieved significance mainly due to the relatively large sample and the small within-group variation. Nevertheless, it should be noted that all participants showed moderate adherence to this dietary pattern (38% among people in the low SES vs. 40% among people in the medium or high SES groups).

Concerning psychological status the analysis of the data revealed that people in the middle or high SES group had a significantly lower depression score compared to participants in the low SES group.

Distribution of bio-clinical characteristics by SES

The collected information also included various biological and clinical characteristics of the participants. Data analysis revealed that people in the lowest tertile of the SES index had a significantly higher prevalence of hypercholesterolemia compared to the medium or the highest tertile ($p = 0.002$). Also, people in lower SES classes had higher LDL-cholesterol and triglycerides levels. However, individuals in the lower or medium SES classes showed higher compliance to the use of lipid lowering agents ($p = 0.03$). Moreover, an inverse association was found between SES and obesity. People in the lowest tertile had a significantly higher prevalence of obesity ($p < 0.001$) and higher BMI ($p = 0.002$) than those in the medium or highest SES tertile. No differences were observed between SES classes regarding central fat indices, i.e. waist-to-hip ratio. In addition, a significant association was found between SES classes and hypertension prevalence, showing that people in the lower SES groups were more likely to have high blood pressure levels. All SES groups showed good compliance to anti-hypertensive medication, i.e. >80%. The results observed regarding the prevalence of diabetes and blood glucose levels showed no significant differences between SES groups.

The cumulative distribution of CVD risk factors was calculated for smoking, physical inactivity, obesity, hypertension, diabetes and hypercholesterolemia. The average number of CVD risk factors was 2.2 (median 2) in males and 2.8 in females (median 3) ($p < 0.001$), while none of the participants had all six risk factors. Fig. 1 illustrates this distribution by SES level. There was an inverse relationship between the cumulative distributions of the classical CVD risk factors by SES ($p < 0.001$). Specifically, the SES pattern differs between the participants, i.e. those having 0 or 1 risk factors were more likely to be in the high SES, while the opposite was observed among those who had more than three risk factors. (Fig. 1) Furthermore, age—sex adjusted logistic regression analysis showed that people in the lowest or medium SES group were 47 ± 11% more likely to have one additional CVD risk factor compared to people in the highest SES class ($p = 0.0001$).

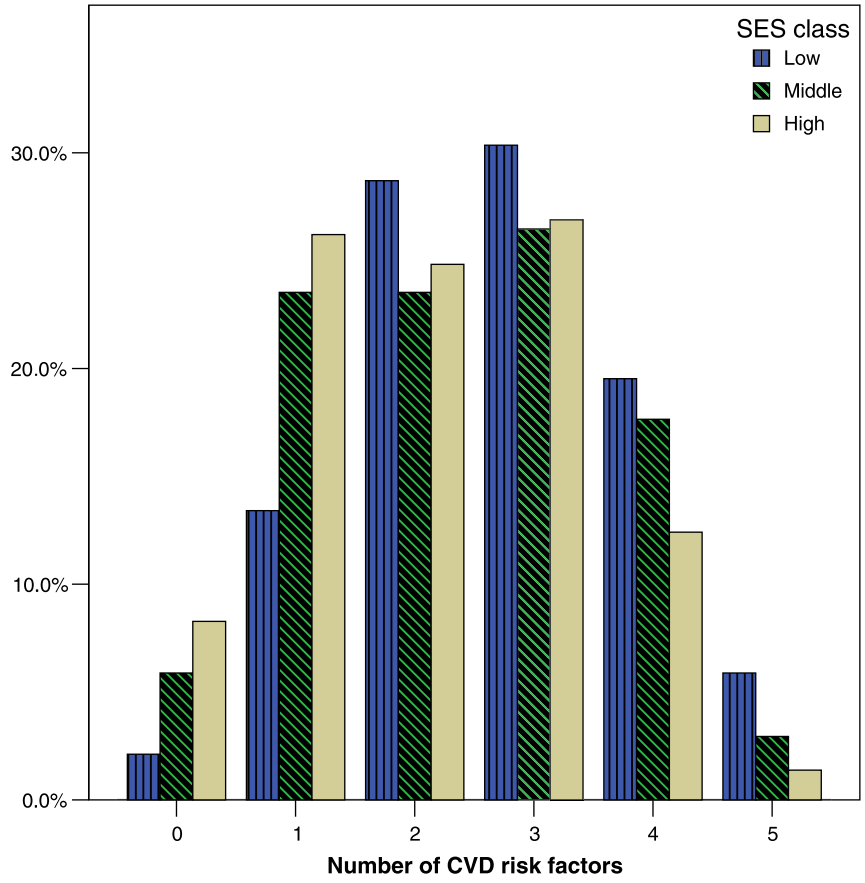

Figure 1 Cumulative distribution of CVD risk factors by SES in elderly men and women from the MEDIS study.

Taking into account the age and sex as well as the associations between SES and several characteristics of the participants, i.e. diet, depression status, place of living, we re-evaluated the association of SES status on the prevalence of the investigated CVD risk factors. In the initial model that included only age, sex and place of living, we found that compared to people in the highest SES, those classified in the lowest SES class were 2.14-times more likely to have four or more of the common CVD risk factors, i.e. smoking, physical inactivity, obesity, hypertension, diabetes and hypercholesterolemia (Table 3). When dietary habits were taken into account (through the MedDietScore), SES lost a part of its significance, but still remained significant (Table 3). Moreover, the interaction term between MedDietScore and SES group was borderline significant ($p = 0.08$) and indicated that lower adherence to the Mediterranean dietary pattern by lower SES groups increases the likelihood of having four or more of the common CVD risk factors (i.e. individuals at high risk). When the geriatric depression scale score was included in the model, data analysis revealed that people in the lowest SES class had a 2.51-times (Table 3) higher likelihood of having four or more CVD risk factors, irrespective of age, sex and depression status. Moreover, an interaction was observed between SES class and GDS score ($p < 0.001$), suggesting that people in the lowest SES and high GDS score (i.e. >7) have 4.5-times (95% CI 1.38—14.69) higher probabilities of having four or more CVD risk factors. No differences were observed in the aforementioned results when the analyses were stratified by sex or by place of living (data not shown in text).

Discussion

We studied the association between SES and several clinical and biochemical factors related to CVD among elderly people who were without any clinical evidence of CVD. We revealed that low SES was associated with increased levels of various biochemical and clinical indices, and this relationship indicated a higher likelihood of having an increased number of risk factors that promote the development of CVD. Differences in

dietary habits and depression status between SES groups did not explain much of the influence of SES on the profiles of CVD risk factors in the participants.

In order to define SES, three indicators have been used most often: occupation, education and income. However, the relatively weak correlation of these three indices on developed countries (correlation coefficients ranges from 0.3 to 0.6) suggests that although these indices measure the same concept, they cover different aspects of the socio-economic structure contributing individually to the relationship between SES and disease [18]. Moreover, it has not yet been defined which social factor is most suitable to determine the social level and its relation to health status. Thus, in this work, and due to the lack of accurate measures of SES in Greece, we decided to combine two of the three features of social status, i.e. education and income, in a special ''socio-economic'' index by multiplying the years of schooling of each individual with the classification of their annual income. Studying elderly people living in Mediterranean islands we particularly found that participants in the upper SES group had a lower prevalence of hypercholesterolemia and hypertension. It has to be mentioned that a desirable risk factor profile of participants would be a total cholesterol of less than 200 mg/dl, LDL cholesterol less than 130 mg/dl, HDL cholesterol greater than 35 mg/dl and triglyceride level less than 200 mg/dl [19]. Although the mean values for HDL cholesterol and triglyceride levels were satisfactory in all three SES groups that was not the case regarding total and LDL cholesterol, which had higher mean values than the desirable profile. We also observed an inverse association between SES and obesity ($p < 0.001$), which was in accordance with the relationship observed in other countries [20–22]. Although, the high SES group was much more physically active than the other two groups, this relationship did not influence the observed association between SES and obesity in our sample.

Regarding high blood pressure levels, we observed that people in the low SES class were more likely to have hypertension compared to those in middle and high SES. However, no differences were observed when blood pressure (systolic and diastolic) measurements were taken into account, indicating that all participants seem to adequately control their blood pressure levels. The latter is also supported by the increased compliance to antihypertensive medication (>80% in all SES groups), which has been observed in other studies, as well [22]. Skliros et al. also observed a high level of awareness but a poor control of hypertension among elderly Greeks from the ''Nemea Primary Care'' study [23]. Although the high SES group exhibited lower mean glucose values and a lower prevalence of diabetes mellitus (Table 2) there was no significant association between SES groups and glycemic control indices.

Table 2 Clinical and biological characteristics of the participants in the MEDIS study, by SES

	Socio-economic status			*p*
	Low	Medium	High	
Body mass index (kg/m^2)	29.45.2	28.0 ± 4.6*	27.5 ± 4.5**	0.002
Obesity (%)	41	25**	28**	< 0.001
Waist to hip ratio	0.95 ± 0.2	0.96 ± 0.1	0.98 ± 0.3	0.261
Systolic blood pressure (mmHg)	139.4 ± 15.6	137.0 ± 16.0	136.1 ± 7.3	0.332
Diastolic blood pressure (mmHg)	80.9 ± 9.8	80.8 ± 9.6	79.0 ± 8.1	0.973
Hypertension (%)	71	73	58**	0.003
Use of anti-hypertensive treatment (%)	85	81	88	0.277
Total cholesterol (mg/dl)	239.1 ± 38.1	225.6 ± 35.8	204.0 ± 30.0*	0.03
HDL cholesterol (mg/dl)	56.2 ± 11.2	55.9 ± 11.1	57.7 ± 8.3	0.914
LDL cholesterol (mg/dl)	153.9 ± 31.8	151.4 ± 35.5	137.8 ± 27.9	0.061
Triglycerides (mg/dl)	155.3 ± 58.3	148.8 ± 68.4	116.0 ± 30.6*	0.039
Hypercholesterolemia (%)	54	39*	40*	0.002
Use of lipid lowering agents (%)	60	71	30**	0.030
Glucose (mg/dl)	112.7 ± 38.4	114.6 ± 33.6	91.2 ± 23.8	0.244
Diabetes mellitus (%)	22	19	15	0.323
Use of anti-diabetic treatment (%)	81	72	63	0.237
Number of CVD risk factors (0–6)	2.69 ± 1.1	2.35 ± 1.1*	2.01 ± 1.18**	0.0001

Data are presented as mean ± SD or relative frequencies (%).
*P-values < 0.05 and **P-values < 0.01 between high, medium vs. low socio-economic groups, after correcting for multiple comparisons through the Bonferroni rule.

Table 3 Results from logistic regression analysis (Odds ratio (95% CI)) that evaluated the role of SES on the likelihood of having four or more CVD risk factors (smoking, physical inactivity, obesity, hypertension, diabetes and hypercholesterolemia), after various adjustments

	Model 1	Model 2	Model 3
Age (per 1 year)	0.98 (0.96–1.00)	0.98 (0.96–1.00)	0.95 (0.91–0.98)
Males vs. females	0.98 (0.76–1.30)	0.97 (0.73–1.23)	1.42 (0.90–2.20)
Rural vs. urban	0.48 (0.36–0.65)	0.49 (0.36–0.66)	0.56 (0.37–0.86)
Low vs. high SES	2.14 (1.24–3.71)	1.84 (1.02–3.46)	2.51 (1.27–4.98)
MedDietScore (per 1/55 unit)	–	0.97 (0.94–1.00)	0.95 (0.90–1.01)
GDS score (per 1/15 unit)	–	–	1.13 (1.07–1.19)

To summarize the cardiovascular risk factors profile of our participants, we created a cumulative variable that included sedentary lifestyle, smoking habit, and presence of hypertension, hypercholesterolemia, diabetes and obesity. It is notable that the average number of CVD risk factors was 2.2 in males and 2.8 in females, which was lower than one would expect taking into account that the mean age of the sample was approximately 75 years. Moreover, despite the low prevalence of CVD risk factors, a strong inverse relationship was observed between SES and the number of risk factors in each individual. As might be expected, the aforementioned associations could be attributed to certain health behavioral differences among SES groups, namely diet, psychological profile, compliance to medication etc. When the sample was divided into those who had four or more CVD risk factors and the rest of the participants, we observed that people in the lowest SES class were two-times more likely to have four or more of the common CVD risk factors, while this relationship was partially explained when dietary habits were taken into account, but enhanced when depressive symptoms were present. People in the upper SES tended to have greater adherence to the Mediterranean diet (Table 1), and this finding of higher SES better dietary habits has been reported by several other investigators before [24]. Van Rossum and colleagues reported that although differences in dietary habits between social classes were small in the Rotterdam study [25], these differences support the role of diet in the explanation of socio-economic inequalities in cardiovascular health. In our work the effect of low SES on CVD risk factors profile was reduced from 2.1 to 1.8 (i.e. 14%) when differences in dietary habits of the individuals were taken into account according to the level of adherence to the Mediterranean diet. Moreover, it is of interest that the level of adherence to the Mediterranean type of diet was lower than one would expect, i.e. mean values varied from 20 to 22 out of 55, which was the highest score. Thus, it can be speculated that people in the low SES find it more difficult to adopt the Mediterranean diet. Kafatos et al. [26], studying the Cretan cohort of the Seven Countries study observed that dietary habits of elderly people showed increases in the intake of saturated fat and decreases in monounsaturated fat over the 30 year follow up period. On the contrary, Stathakos et al., studying a sample of Greek centenarians living on the mainland and some islands reported after the age of 65, the majority were consuming olive oil, dairy products, and vegetables every day, poultry, fish and legumes two or three times a week and red meat rarely [27].

Furthermore, low socio-economic status has been associated with a higher prevalence of depression and other psychological disorders, as well as higher CVD risk [28–30]. This study confirmed that people in low SES groups had higher levels of the GDS score, indicating more severe depressive symptoms. Moreover, our analysis showed that people in the lowest SES with a high GDS score experience 4.5-times higher probabilities of having four or more CVD risk factors, irrespective of various potential confounders. Alexopoulos in a review paper suggested that among elderly people, depression causes suffering, family disruption, disability, and worsens the outcomes of many medical illnesses, and increases mortality from all causes [31]. Our findings seem to support this theory, especially in low SES people.

Limitations

The present study used a cross-sectional design and therefore has several limitations. One limitation that is observed in most nationwide population surveys is that the poor are usually not well represented, because the homeless, unemployed or migrants not speaking the dominant language are difficult to reach [32]. Another limitation of

the cross-sectional design is the ability to associate observed differences as causal. Moreover, in nutritional studies that use self-reported data, social desirability reporting bias is possible especially in the higher SES since the better-educated class is more likely to be conscious of desirable eating habits. Finally, there is no specific tool that measures SES in Greece. This may limit our findings since people from various SES groups may have been misclassified. Another limitation is the use of a single measurement of total cholesterol, glucose and blood pressure levels, for the definition of hypercholesterolemia, diabetes and hypertension. Although this is a formal procedure in epidemiological studies, overestimation of these conditions may exist. Furthermore, although the questionnaire was strictly confidential we cannot exclude that some people may overestimate or underestimate their income or education status. This may influence their classification to SES groups but we believe that this did not alter the strength of the observed associations.

Conclusion

The results clearly show that there is a gap between high- and low-SES groups regarding various CVD risk factors. This finding underlines the importance of primary prevention and control of these risk factors levels, especially in low SES people. Nevertheless, further studies are needed to understand why lower SES groups have more adverse levels of CVD risk factors.

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