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Epidemiology of cardiovascular risk factors in Greece: aims, design and baseline characteristics of the ATTICA study

Christos Pitsavos, Demosthenes B Panagiotakos*, Christina Chrysohoou and Christodoulos Stefanadis

Address: A' Cardiology Clinic, School of Medicine, University of Athens, Athens, Greece

Email: Christos Pitsavos - d.b.panagiotakos@usa.net; Demosthenes B Panagiotakos* - d.b.panagiotakos@usa.net; Christina Chrysohoou - d.b.panagiotakos@usa.net; Christodoulos Stefanadis - d.b.panagiotakos@usa.net

* Corresponding author

Abstract

Background: In an attempt to evaluate the levels of several cardiovascular risk factors in Greece we conducted a population-based health and nutrition survey, the "ATTICA study". In this work we present the design and the methodology of the study, as well as the status of various baseline characteristics of the participants.

Methods: From May 2001 to December 2002 we randomly enrolled 1514 adult men and 1528 adult women, stratified by age – gender (census 2000), from the greater area of Athens. More than 300 demographic, lifestyle, behavioral, dietary, clinical and biochemical variables have been recorded.

Results: Regarding the frequency of the classical cardiovascular risk factors we observed that 51% of men and 39% of women reported smokers ($p < 0.05$), 37% of men and 25% of women were defined as hypertensives ($p < 0.05$), 46% of men and 40% of women had total serum cholesterol levels above 200 mg/dl ($p < 0.05$) and 8% of men and 6% of women had history of diabetes mellitus. Moreover, 20% of men and 15% of women were obese ($p < 0.05$), while men were more physically active as compared to women (42% vs. 39%, $p < 0.05$). 19% of men and 38% of women had mild to severe depressive symptoms ($p < 0.01$). Finally, 72 men (5%) and 45 (3%) women reported history of coronary heart disease at entry evaluation.

Conclusions: The prevalence of the common cardiovascular risk factors in our population seems high. As a consequence a considerable proportion of Greek adults are at "high-risk" for future cardiovascular events.

Background

During the past few years several studies have suggested factors that are more or less related to the development of cardiovascular disease [1–4]. However, many epidemiologists have revealed differences in the effect of risk factors on the development of the disease between populations [1]. A potential explanation, regarding the previous outcome, can be attributed to several behavioral

characteristics and environmental conditions [4]. Thus, locally based epidemiological studies are considered essential [5].

Until now days, the prevalence of the conventional cardiovascular risk factors, in Greece, has been, mainly, based on the findings from the Seven Countries Study that started in the early 1960s [3] and from two local studies that reported their results in the early 1980s [6,7]. Recently, the CARDIO2000 study [8] investigators reported their findings regarding the association between several socio-demographic, dietary and clinical factors and the risk of developing acute coronary syndromes. However, during the past years, Greece has experienced marked but uneven socio-economic development, with the average income increasing by about 20-fold [9]. Consequently, the lifestyle of people throughout the country has changed dramatically.

Current data regarding the prevalence of cardiovascular risk factors in a Greek population are lacking. In an attempt to close this gap we conducted a population-based survey (the "ATTICA study") that has been approved by our Institutional Ethics Committee and funded by research grants from the Hellenic Cardiological Society. In this work we present the design and the methodology of the study, as well as the status of various baseline characteristics of the participants.

Methods

In the beginning of 2001 the First Cardiology Department of the University of Athens (under the auspices of the Hellenic Cardiological Society) conducted a health and nutrition survey, the "ATTICA" study. The study is being carried out in the province of Attica (including 78% urban and 22% rural areas), where Athens, is a major metropolis. The Institutional Ethics Committee has approved the study's protocol and the Hellenic Cardiological Society funds this study by research grants.

Aim of the Study

The goals of the ATTICA study are: (a) to record the distribution of several blood lipids, clinical, inflammatory, coagulation, oxidation and thrombotic factors, in a representative sample of adult men and women, (b) to explore the associations between these factors with several socio-economic, lifestyle and psychological characteristics of the participants, and (c) to evaluate the prognostic significance of these factors on the incidence of coronary heart disease through periodic follow up examinations of the participants at 1, 5 and 10 years after the entry.

Design of the study

The sampling was random, multistage (by city) and was based on the age – sex distribution of the province of Attica provided by the National Statistical Service, according to the census of 2000. We enrolled only one participant per household, while according to the study's protocol all people living in institutions were excluded from the sampling. From May 2001 to December 2002, 4056 inhabitants from the above area were randomly selected and asked to participate into the study. Of them, 3042 agreed to participate (75% participation rate). All participants were interviewed by trained personnel (cardiologists, general practitioners, dieticians and nurses), using a standard questionnaire.

Power analysis showed that the number of enrolled participants is adequate to evaluate two – sided differences between subgroups of the study and the investigated parameters greater than 20%, achieving statistical power > 0.80 at < 0.05 probability level (P-value).

Investigated measurements

The questionnaire included questions about demographic and behavioral characteristics, detailed medical history of cardiovascular risk factors, as well as dietary and lifestyle habits of the participants.

Socio-demographic and lifestyle variables

The educational level of the participants (as a proxy of social status) was measured by the years of schooling. For simplicity we also classified the participants into three groups: Group I: < 9 years, Group II: up to high school or technical colleges (10 – 14 years) and Group III: university. Mean annual income during the past three years was recorded and the financial status of the participants was classified into four groups: low: < 8000 Euro, medium: 8000 – 10000 Euro, high: 10000 – 20000 Euro and very high: > 20000 Euro. Information about the marital status (married, never married, divorced or widowed) as well as number of children per family was also recorded.

Current smokers were defined as those who smoked at least one cigarette per day; never smokers those who have never tried a cigarette in their life and former smokers were defined as those who had stopped smoking for at least one year. Occasional smokers (less than 7 cigarettes per week) were recorded and combined with current smokers due to their small sample size. For a more detailed evaluation of smoking habits we calculated the pack-years (cigarette packs per day × years of smoking), adjusted for a nicotine content of 0.8 mg / cigarette.

For the evaluation of physical activity status we developed an index of weekly energy expenditure as follows: we assessed the frequency (times per week), duration (in minutes) and intensity of sports related physical activity during the same period. Intensity was gradated in qualitative terms such as: light (expended calories < 4 Kcal/ min,

i.e. walking slowly, cycling stationary, light stretching etc.), moderate (expended calories 4–7 Kcal/ min, i.e. walking briskly, cycling outdoor, swimming moderate effort etc.) and high (expended calories >7 Kcal/ min, i.e. walking briskly uphill, long distance running, cycling fast or racing, swimming fast crawl etc.). Participants who did not report any physical activities were defined as sedentary. For the rest of the participants we calculated a combined score by multiplying the weekly frequency, duration and intensity of physical activity. Then we calculated the tertiles of this score. Thus physically active participants were classified into three groups: low physical activity (1st tertile), medium physical activity (2nd tertile) and high physical activity (3rd tertile). The presence of occupational exercise was also recorded.

Height was measured, to the nearest 0.5 cm, without shoes, back square against the wall tape, eyes looking straight ahead (visual axis is horizontal when the top of external auditory meet us is level with the inferior margin of bony orbit), with a right-angles triangle resting of the scalp and against the wall. Weight was measured with a lever balance, to the nearest 100 g, without shoes, in light undergarments. Then body mass index was calculated as weight (in kilograms) divided by standing height (in meters squared). According to standard guidelines obesity was defined as body mass index > 29.9 Kg / m^2.

Dietary assessment
The evaluation of the nutritional habits was based on a validated food-frequency questionnaire according to the guidelines from the section of Nutrition of our Institution [10]. We asked all participants to report the average intake (per week or day) of several food items that they consumed (during the last 12 months). Then, the frequency of consumption was quantified approximately in terms of the number of times a month this food was consumed. Thus, daily consumption multiplied by 30 and weekly consumption multiplied by 4 and a value of 0 was assigned to food items rarely or never consumed. Alcohol consumption was measured in wineglasses (100 ml) and quantified by ethanol intake (grams per drink). One wineglass was equal to 12% ethanol concentration. In order to describe overall diet we used composite scores, which are necessary for the evaluation of epidemiological associations.

According to a Harvard-led group with substantial input from Greek scientists [11] a dietary pyramid was developed to describe the Mediterranean dietary pattern. This dietary pattern consist of: (a) daily consumption: of non refined cereals and products (whole grain bread, pasta, brown rice, etc), vegetables (2 – 3 servings/day), fruits (6 servings/day), olive oil (as the main added lipid) and dairy products (1 – 2 servings/day), (b) weekly consump-

tion: of fish (4 – 5 servings/week), poultry (3 – 4 servings/ week), olives, pulses, and nuts (3 servings/week), potatoes, eggs and sweets (3 – 4 servings/week) and monthly consumption: of red meat and meat products (4 – 5 servings/month). It is, also, characterized by moderate consumption of wine (1 – 2 wineglasses/day) and high monounsaturated: saturated fat ratio (> 2) [10,11]. Based on this dietary pyramid we calculated a special diet score that assessed adherence to Mediterranean diet. In particular, for the consumption of food items that are close to this dietary pattern we assigned score 0 for rare or no consumption, 1 for 1 to 4 times / month, 2 for 5 to 8 times, 3 for 9 to 12 times / month, 4 for 13 to 18 times / month and 5 for almost daily consumption. On the other hand, for the consumption of foods that are away from this traditional diet, like meat and meat products, we assigned the opposite scores (i.e. 0 for almost daily consumption to 5 for rare or no consumption). For alcohol, we assigned score 5 for consumption of less than 3 wineglasses per day, score 0 for consumption of more than 7 wineglasses / day and scores 1 to 4 for consumption of 3, 4 – 5, 6 and 7 wineglasses per day.

Higher values of the suggested dietary score indicates adherence to the traditional Mediterranean diet (i.e. which is also characterized by moderate consumption of fat and high monounsaturated: saturated fat ratio), while lower values indicate adherence to the "Westernized" diet. We defined subjects who are "closer" to the Mediterranean type of diet using as cut-off points the median values of this food consumption score as done by several investigators [11].

We also asked the participants about their usual frequency of consumption of various types of coffee or tea. All reported types of coffee (instant coffee, «Greek» type, filtered or «cappuccino») were adjusted for one cup of 150 mL coffee and concentration of 27.5% caffeine. We also recorded the consumption of decaffeinate coffee and caffeine containing soft drinks (coca-cola) or chocolate consumption.

Psychological evaluation
We assessed depressive symptoms of all participants using a translated and validated (by the Psychiatry Department of our Institution) version of the Zung's Self-Rating Depression Scale (SDS) [12]. This scale is a well-known and world-widely used self-rating scale for the measurement of depression. It was originally developed in order to assess depression symptoms without the bias of an administrator affecting the results. Higher scores on this scale are indicative of more severe depression [12]. ZDRS consists of 20 items that cover affective, psychological, and somatic symptoms. The patient specifies the frequency with which the symptom is experienced (that is: a

little = 1, some = 2, a good part of the time = 3, or most of the time = 4). According to the validation procedure an individual with ZDRS score below 45 is considered normal, with a score of 45–59 is considered to suffer from mild depression, with score 60–69 depression is considered moderate, while with a score of 70 or above depression is considered to be severe [12].

Furthermore, all participants were also completed the Hostility and Direction of Hostility questionnaire (HDHQ) [13] which was translated and validated in our Institution for the purposes of the study. The HDHQ includes components of the Minnesota Multiphasic Personality Inventory and is purported to be a measure of hostility and anger (range of the HDHQ scale: 0 – 55). The assessment instrument consists of five subscales: (a) the urge to act out hostility, (b) criticism of others, (c) projected delusional or paranoid hostility, (d) self-criticism and (e) delusional guilt.

Clinical characteristics

Arterial blood pressure was measured at the end of the physical examination with subject in sitting position and at least 30 minutes at rest. Blood pressure measurements were taken by a cardiologist, three times, at the right arm relaxed and well supported by a table, with an angle of 45° from the trunk (ELKA aneroid manometric sphygmometer, Von Schlieben Co, Munich, Germany). The systolic blood pressure level was determined by the first perception of sound (of tapping quality). The diastolic blood pressure level was determined by phase V when the repetitive sounds become fully muffed (disappear). Changes in loudness were not considered. Patients whose average blood pressure levels were greater or equal to 140 / 90 mm Hg or were under antihypertensive medication were classified as hypertensives, as it is commonly done in epidemiological studies. Hypercholesterolemia was defined as total serum cholesterol levels greater than 200 mg / dl or the use of lipid lowering agents. Diabetes mellitus was defined as a fasting blood sugar > 125 mg/dl or the use of antidiabetic medication.

Biochemical measurements

Blood samples were collected from the antecubital vein between 8 to 10 a.m., in a sitting position after 12 hours of fasting and alcohol abstinence. The biochemical evaluation was carried out in the same laboratory that followed the criteria of the World Health Organization Lipid Reference Laboratories. All biochemical examinations (serum total cholesterol, oxidized LDL-cholesterol, HDL-cholesterol and triglycerides) were measured using chromatographic enzymic method in a Technicon automatic analyzer RA-1000 (Dade Behring, Marburg, Germany). We also measured apolipiproteins A1 and B, as well as lipoprotein-(a) by a latex enhanced turbidimetric

immuno-assay. HDL cholesterol was determined after precipitation of the Apolipoprotein B containing lipoproteins with dextran-magnesium-chloride. Non-HDL cholesterol was calculated by the formula: total cholesterol minus HDL-cholesterol. Serum for the measurement of these lipids was harvested immediately after admission. Finally, LDL cholesterol calculated using the Friedewald formulae: {total cholesterol} - {HDL cholesterol} - 1/5 (triglycerides). Non-HDL cholesterol is the total cholesterol minus HDL cholesterol. An internal quality control was in place for assessing the validity of cholesterol, triglycerides and HDL methods. The intra and inter-assay coefficients of variation of cholesterol levels did not exceed 9%, triglycerides 4% and HDL 4%.

High sensitivity C-reactive protein levels, homocysteine and fibrinogen levels were measured by a BNII Dade Behring automatic nephelometry. For the determination of plasma fibrinogen blood was anticoagulated with 3.8% trisodium citrate (9:1 vol/vol) and cooled on ice until centrifugation. The intra and inter-assay coefficients of variation of fibrinogen did not exceed 9%. Finally, blood samples were frozen to -80°C for future genomic evaluation.

Prevalence of coronary heart disease

The history of ischemic heart disease (ICD 10 codes I20 – I25) and cerebrovascular disease (ICD 10 codes I60 – I69) was also recorded. The classification was based on participants' medical records that evaluated during the enrollment into the study.

Statistical analysis

Continuous variables are presented as mean values ± one standard deviation, while qualitative variables are presented as absolute and relative frequencies. Associations between categorical variables were tested by the use of contingency tables and the calculation of Pearson's chi-squared test. Comparisons between normally distributed continuous variables across several groups of participants were performed by the calculation of multi way Analysis of Co-Variance (MANCOVA), after controlling for equality of variances and adjusting for several potential confounders.

All reported *P*-values are based on two-sided tests and compared to a significance level of 5%. SPSS version 11.0 (Statistical Package for Social Sciences, SPSS Inc, Illinois, U.S.A.) software was used for all the statistical calculations.

Table 1: Socio-demographic and lifestyle characteristics of the participants

	Men (1524 or 50%)	Women (1518 or 50%)	P
Socio-demographic variables			
Age (years)	46 ± 13	45 ± 13	0.140
Education status (n, %)			0.037
Group I	335 (22%)	380 (25%)	
Group II	594 (39%)	622 (41%)	
Group III	595 (39%)	516 (34%)	
Financial status (n, %)			< 0.001
Low	130 (13%)	259 (29%)	
Medium	337 (33%)	305 (34%)	
High	400 (39%)	267 (30%)	
Very high	149 (15%)	73 (7%)	
Lifestyle variables			
Smoking habits (n, %)			< 0.001
Never smoker	517 (34%)	822 (54%)	
Current smoker	781 (51%)	596 (39%)	
Former smoker	230 (15%)	100 (7%)	
Physical activity status (n, %)			0.005
Sedentary	874 (57%)	903 (59%)	
Low	200 (13%)	142 (9%)	
Medium	221 (15%)	245 (16%)	
High	212 (15%)	228 (15%)	

Results

Socio-demographic and lifestyle characteristics of the participants

The selected sample can be considered as representative of the Attica region population, since there were only minor differences between the study population and the target population as regards the sex and age distribution (Pearson's chi-square = 0.23, p = 0.567).

The distribution of several socio-demographic and lifestyle characteristics is presented in Table 1. Men had similar age distribution as compared to women. Moreover, men were more educated and wealthy, as well as were more frequently current or former smokers as compared to women. In addition, men seem to be more physically active. Regarding the marital status, the majority of men (72%) and women (64%) participants were married, while the rest of them were never married (23% of men and 24% of women), divorced (3% of men and 6% of women) or widowed (2% of men and 6% of women).

Clinical and biochemical measurements

37% of men and 25% of women were defined as hypertensives. Isolated systolic hypertension (systolic blood pressure levels greater than 140 mm Hg) was observed in 6% of men and 6% of women, while isolated diastolic hypertension (diastolic blood pressure levels greater than 90 mm Hg) was observed in 7% of men and 3% of women. The majority of men (64%) and women (42%)

were untreated and of those who were treated, only, 36% were adequately controlled. Thus, only 20% of the hypertensive population was well controlled.

Mean values of the investigated blood lipids are presented in Table 2. Men had on average higher total cholesterol levels compared to women. As a consequence, 46% of men and 40% of women had total serum cholesterol levels above the threshold of 200 mg/dl. Of those who had abnormal total cholesterol levels at interview, 40% of men and 30% women reported that they were unaware about their condition. In addition, 15% of men and 14% of women had cholesterol levels above 240 mg/dl. Focusing our analysis in older adults (>50 years old) we observed that 49% of men and 52% of women had high total cholesterol levels (>200 mg/dl). Similar results were observed regarding HDL – cholesterol (Table 2). We also observed that 21% of men and 7% of women had very low HDL – cholesterol levels (<35 mg/dl). Furthermore, of those who had total cholesterol levels < 200 mg/dl, 19% of men and 12% of women had HDL cholesterol levels lower than 35 and 45 mg/dl, respectively. Men had higher triglycerides levels compared to women (Table 2). Approximately, 28% of men and only 13% of women had high triglycerides levels (> 150 mg/dl). 15% of men and 14% of women had LDL cholesterol levels above 160 mg/dl. In addition, 50% of men and 46% of women had LDL cholesterol levels greater than 130 mg/dl.

Table 2: Clinical characteristics of the participants

	Men (1524 or 50%)	Women (1518 or 50%)	P
Systolic blood pressure (mm Hg)	126 ± 38	119 ± 36	< 0.001
Diastolic blood pressure (mm Hg)	82 ± 30	76 ± 14	< 0.001
Prevalence of hypertension	563 (37%)	379 (25%)	< 0.001
Total serum cholesterol (mg/dL)	195 ± 42	191 ± 41	0.017
Prevalence of hypercholesterolemia	701 (46%)	605 (40%)	0.023
HDL-cholesterol (mg/dL)	44 ± 15	52 ± 14	< 0.001
Non-HDL – cholesterol (mg/dL)	155 ± 44	143 ± 40	< 0.001
LDL-cholesterol (mg/dL)	125 ± 38	118 ± 36	0.001
Triglycerides (mg/dL)	138 ± 57	103 ± 56	0.001
Blood glucose (mg/dL)	96 ± 31	90 ± 21	< 0.001
Prevalence of diabetes mellitus	110 (8%)	84 (6%)	0.511
Body mass index (kg/m^2)	27.4 ± 4	25.3 ± 5	< 0.001
Obesity	308 (20%)	234 (15%)	0.001

Of those who had already known blood lipids abnormalities, 37% of men and 35% of women followed a dietary medication and 32% of men and 22% of women were under a pharmaceutical treatment. Men tended to be more complied with medication as compared to women (p = 0.052). Statin was the main lipid-lowering agent (*55% received atorvastatin, 15% pravastatin, 12% simvastatin and 10% another type of statin*), followed by fibrates (7%) and other lipid lowering drugs (≈1%). However, only the 49% of men and the 51% of women who were under pharmacological treatment reached desirable total cholesterol levels (<200 mg/dl).

8% of men and 6% of women had history of diabetes mellitus. Prevalence of diabetes increased proportionally with age in both genders (p – value for trend = 0.001). In particular 2% of men and 1% of women before the age of 45 were classified as diabetic, while 29% of men and 21% of women after the age of 65 had diabetes mellitus.

Men had higher body mass index as compared to women. This confirmed even after controlling for age. As a consequence men were more obese than women. Moreover, 72% of men and 45% of women had body mass index greater than 25 kg/m^2 (overweight).

The levels of various inflammation, coagulation and thrombotic markers are presented in Table 3. The observed differences between genders remained statistically significant even after adjusting for several potential confounding factors like age, smoking habits, body mass index, physical activity status and food items consumed by the participants. Moreover, 45% of men and 55% of women had C-reactive protein levels below 1 mg/L, while 15% of men and 17% of women had greater than 3 mg/L.

In addition, less than 3% of men and women had C-reactive protein levels above 10 mg/L.

Psychological evaluation
Women had significantly higher values of the Zung's depression scale as compared to men (37 ± 9 vs. 33 ± 10, p < 0.001). The previous association confirmed even when we adjusted for age, education and financial level and family status of the participants. As a consequence, the distribution of depression symptomatology differed significantly between men (normal: 81%, mild to moderate 18%, severe 1%) and women (normal: 62%, mild to moderate 37%, severe 1%). We also observed a U-shape distribution of depression across age. In particular, mild to severe depression prevailed in 21% of men and 47% of women before the age of 40, in 47% of men and 52% of women after the age of 60, while prevailed in 20% of middle aged men and in 30% of middle aged women.

111 (27%) of the participants were classified in the upper quartile of the hostility score (>21 score in the 0 – 55 scale) and 119 (29%) were classified in the lower quartile (< 11 score). No statistically significant differences were observed between genders (p = 0.570). Further analysis showed that hostility score was inversely related with age (r = -0.116, p = 0.036) and education status (r = -0.281, p < 0.001) of the participants. Analyzing the five dimensions of the hostility questionnaire we observed that only self-criticism and delusional guilt seems to be higher in females as compared to males (p < 0.001). No statistically significant differences were found as regards the urge to act out hostility, criticism of others, and projected delusional or paranoid hostility.

Table 3: Levels of inflammation, thrombotic and coagulation markers in men and women

	Men	Women	P
hs C-reactive protein (mg/L)	1.8 ± 1.9	1.7 ± 2.0	0.441
White blood cell (counts)	7.0 ± 2	6.5 ± 2	0.001
Amyloid A (mg / dL)	4.8 ± 7	5.1 ± 6	0.333
Homocysteine (imol/L)	13 ± 6	10 ± 5	0.001
Fibrinogen (mg / dL)	301 ± 67	319 ± 72	0.001
Oxidized LDL-cholesterol (mg/dL)	67 ± 33	58 ± 29	0.001

hs = high sensitivity

Table 4: Weekly frequency of food groups consumed

Food groups	Men (servings/week)	Women (servings/week)	P
Dairy products	5.7 ± 2.2	6.7 ± 2.4	0.001
Any type of fish	1.3 ± 1.2	1.4 ± 1.7	0.901
Fruits	5.8 ± 3.8	5.9 ± 1.5	0.976
Meat (red) and meat products	1.9 ± 1.1	1.7 ± 1.1	< 0.001
Non-refined cereals	1.8 ± 1.5	1.7 ± 1.3	0.099
Potatoes	1.9 ± 0.7	2.5 ± 0.8	0.057
Poultry	1.3 ± 0.7	1.2 ± 0.5	0.551
Pulses	1.5 ± 1.1	1.3 ± 0.8	0.041
Vegetables	1.9 ± 1.5	2.2 ± 1.1	0.006
Sweets	1.1 ± 1.3	1.2 ± 1.8	0.421
Diet score (range 0 – 55)	36 ± 12	38 ± 12	< 0.001
Daily alcohol consumption (ml)	225 ± 45	95 ± 39	< 0.001
"Close" to the Mediterranean diet	502 (33%)	637 (43%)	0.04
Daily coffee/tea consumption (ml)	250 ± 55	150 ± 60	< 0.001

Dietary evaluation

Table 4 illustrates the weekly frequency of several food-groups consumed by the participants. Moreover, 80% of men and 90% of women used olive oil in the preparation of their meals and salads. Dietary analysis revealed that women were "closer" to the Mediterranean diet as compared to men. In addition, men consumed higher quantities of alcohol, tea and coffee, as well as were more likely to consume "junk" food (0.9 vs. 0.6 times per week) as compared to women.

Prevalence of coronary heart disease

72 (5%) men and 45 (3%) women reported history of coronary heart disease at entry evaluation. Moreover, a positive association was observed as regards the age of the participants and the prevalence of coronary heart disease. In particular, coronary heart disease prevailed in less than 1% among participants below 45 years old, 3% in participants between 45 to 55 years old and more than 14% in elderly men and women participants.

Discussion

In this work we presented the rationale, design and baseline characteristics of the ATTICA epidemiological study. We observed that a considerable proportion of the participants had elevated levels of systolic and diastolic blood pressure, serum lipids and blood glucose. In addition, 6 out of 10 men and women reported physically inactive, while one half of men and 4 out of 10 women were current smokers. Moreover, roughly 1 out of 5 men and 1 out of 3 women had mild to severe depressive symptoms.

We are unable to compare our findings with other epidemiological studies from Greece because of lack of relevant data. Only few local, small-scale, observational studies have provided data regarding the prevalence of the common cardiovascular risk factors in Greece. In particular, in 1999, Stergiou et al [14] conducted a survey in a small rural Greek village. The prevalence of hypertension was 30% in men and 27% in women. Our study, based on a much larger representative sample from all urban and rural areas of Attica prefecture, revealed that the prevalence of hypertension was 37% in men and 25% in women. Thus, it could be speculated that approximately

2,8 million Greek adults have elevated blood pressure levels. These ratios were similar with other Westernized countries in which hypertension varied from 24% to 38% [15–18]. It is noteworthy that in all aforementioned studies men had a higher prevalence of hypertension than women. Furthermore, the majority of men and women in our study were untreated and of those who were treated, only, one third were controlled. Thus, only 20% of the hypertensive population was adequately controlled. Our findings underlines the importance of the need for programs in Greece for the detection and control of hypertension similar to those of United States as well as of some other countries have adopted for years [19].

46% of men and 40% of women had total serum cholesterol levels greater than 200 mg/dl. Based on these data, it could be speculated that 1,6 million adult men and 1,4 million adult women in Greece have high total cholesterol levels. Current data regarding the total cholesterol levels in Greek population are lacking. The investigators from the Seven Countries Study [20] reported that in the early 1980s more than 50% of Athenian men and women, between 40 – 59 years old, had total cholesterol levels greater than 240 mg/dl. In another study [6] that also conducted in Athens during the middle 1980s, the investigators reported that hypercholesterolemia (total cholesterol > 240 mg/dl) prevailed in 20% of men and 17% of women adults. Our findings were slightly different to those reported by the National Health and Nutrition Examination Survey (NHANES) III study [21], where 52% of non-Hispanic white adult men and 49% of women in USA had total blood cholesterol levels over 200 mg/dl and 18% of men and 20% of women had total blood cholesterol levels of 240 mg/dl or higher.

The European Network for Smoking Prevention [22] reports that 47% of Greek men and 29% of Greek women adults were current smokers in 1998. The percentage of men smokers was similar in our study, however we observed a 10% higher rate in women. There are, unpublished, evidence that there is a considerable increase in smoking habits among women, but it is still difficult to explain this increase in the prevalence of smoking habits during the last four years. Obesity is an epidemic that may result into an increased prevalence of hypertension and diabetes mellitus in the future. The NHANES III [23] reported that overweight occurred in 33% of the US adult population, while severe overweight in 9%. However, the rates in Greece seem to be much higher, since 20% of men and 15% of women were defined as obese. This may attribute to the high levels of physical inactivity observed in our population, as well as the adherence of a Westernised type of diet.

Men had higher homocysteine, white blood cell counts and oxidised LDL-cholesterol levels, while the had lower fibrinogen levels as compared to women (Table 3). The aforementioned differences remained statistically significant even after controlling for age, smoking habits, body mass index, physical activity status and food items consumed by the participants. Serum amyloid-A and C-reactive protein levels were similar in both genders. Moreover, roughly 15% of men and women had C-reactive protein levels above 3 mg/L, which has recently been suggested as the threshold of defining people at high-risk [24].

The ATTICA study aims at describing the status of cardiovascular risk factors in a representative sample from the Greek population. The presented data provided crude estimations of the prevalence of various factors that are more or less associated with the development of the atherosclerotic disease. It seems that the levels of these risk factors are high. However, much remains unknown regarding the associations between these factors, as well as their relationships with several other lifestyle and behavioural characteristics of the participants. We anticipate that the periodic follow-up of the study may provide useful information regarding the role of these factors on coronary heart disease incidence.

Competing interests
None declared.

Authors' contribution
CP = principal investigator, concept, design of the study, DBP = co-principal investigator, concept, design of the study and data analysis, CC = design and clinical evaluation of the participants and CS = concept and design of the study

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