Cigarette smoking, alcohol consumption, and serum lipid profile among medical students in Greece

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Background: The lack of data regarding health habits of medical students in Greece prompted a cross-sectional study to assess tobacco use, alcohol consumption and serum lipoprotein levels among students in the University of Crete School of Medicine. **Methods:** A self-administered questionnaire on smoking and alcohol consumption was distributed to third-year medical students for twelve consecutive years (1989–2000). A total of 849 students (462 males, 387 females) participated in the survey. Biochemical measurements were taken and multi-variant analysis of the data was performed. **Results:** The prevalence of smoking among males and females was 33.2% (N=150) and 28.4% (N=108), respectively (mean cigarette consumption 13/day). As many as 349 males (77.2%) and 220 females (58.0%) reported consuming alcohol on a regular basis. The prevalence of low HDL-cholesterol (<0.9 mmol/l) was 14.5% in males and 5.1% in females, and of high LDL-cholesterol levels (>4.1 mmol/l) in 11.1% of male and 5.5% of female participants. Smoking was related to higher triglyceride (p=0.032), and lower HDL-cholesterol (p=0.037) serum levels. Total cholesterol, LDL-cholesterol, and the TC/HDL-cholesterol ratio were strongly related with the level of smoking (p=0.006, p=0.008, and p=0.006 respectively). **Conclusions:** The results document a high prevalence of smoking among physicians-to-be in Greece. Tobacco use was strongly associated with a lipid profile predisposing to increased risk for cardiovascular disease. Health promotion programmes should therefore be instituted not only during the first years of medical studies, but rather at a much earlier stage in life.

Keywords: alcohol, lipoproteins, medical students, tobacco

Almost 3000 years after the ancient Greek saying: 'προλαμβανειν κρειττον του θεραπευειν' ('prevent rather than treat'), prevention and health promotion remain as the foundation of medical practice and research. In this respect, physicians are expected not only to provide their patients with medical care and advice but also to set an example for them. Yet, several studies have reported high tobacco and alcohol consumption among physicians and medical students alike.[1–3]

To date, no data are available on tobacco and alcohol consumption among medical students in Greece, a country with the highest per capita consumption of cigarettes among European Union member states.[4] Moreover, there have been no studies in Greece examining the serum lipid profile of young adults and its relationship to tobacco use.

The aim of this descriptive study conducted annually (1989–2000) among third-year medical students in Crete,

Greece, was to obtain baseline data on tobacco and alcohol consumption and examine their relationship to serum lipids.

METHODS

Subjects

The survey was carried out within the training framework of the Clinical Nutrition class, which is presented in the third year of the medical course in the University of Crete Medical School.[5] All students registered in the third year of their studies during the period 1989–2000 (865 in total, 468 males and 397 females) were asked to take part in the survey. A letter was given, at the beginning of the course to all students inviting them to participate and also explaining the aims of the investigations to be conducted during the study.

Data collection

■ Questionnaires

Students who were willing to participate were asked to sign a consent form. Purpose-designed questionnaires were self-administered and included questions on socio-demographic aspects of the students as well as detailed information on tobacco and alcohol consumption. The questionnaires were completed under supervision of the course tutors. In order to validate the results multiple cross-checked questions on the same topic were addressed

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to the participants. The questionnaires remained unchanged over the years.

■ Biochemical measures

Early morning venous blood samples were drawn for lipid analysis, following a 12 hour overnight fast. The blood samples were labelled with the students' identification-numbers, and were transferred to the Nutritional Research Laboratory of the University of Crete on ice packs so as to maintain a temperature of 3–4°C. Blood was centrifuged, and serum triglycerides (TG),[6] total cholesterol (TC),[7] and high-density lipoprotein cholesterol (HDL-C)[8] were determined. Low-density lipoprotein cholesterol (LDL-C) was calculated as follows: LDL-C = TC – (HDL-C + TG/5).[9] The ratio of TC to HDL-C was also calculated. Blood samples were not drawn from students during the 1991–1992 and 1995–1996 academic years for technical reasons.

Definitions

■ Smoking

Smokers were classified as those who stated smoking more than one cigarette per day for at least three consecutive months. Ex-smokers were defined as those who had not been smoking for the last three consecutive months. Non-smokers were defined as those who did not fall in any of the two previous groups.

■ Alcohol consumption

Participants were asked about their weekly consumption of alcoholic beverages (beer, wine, liquor) during the last three months. The number of grams of pure alcohol reported was calculated using the following conversions: one 12 oz glass of beer equal to 12 grams, one 4 oz glass of wine equal to 12 grams, and one 1 oz glass of liquor (vodka, 'ouzo', 'raki') equal to 20 grams of pure alcohol.

■ Assignment of risk factors for cardiovascular disease

Risk factors were assigned according to the Adult Treatment Panel II (ATP) criteria.[10] Total cholesterol was considered as elevated or borderline high when its serum concentration was respectively equal to or exceeded 6.2 and 5.2 mmol/l (5.2–6.2 mmol/l). Similar cut-off levels for LDL-C were 4.1 and 3.4 mmol/l (3.4–4.1 mmol/l). HDL-cholesterol was defined as low when <0.9 mmol/l, and triglycerides were considered high when ≥1.6 mmol/l.

Statistical analysis

The chi-square (χ^2) test was used to examine differences in prevalence of tobacco use, alcohol consumption, and dyslipidaemia between the genders. In analyses treating tobacco consumption as a categorical variable, average differences in serum lipids and lipoproteins were calculated using analysis of covariance (ANCOVA) with covariates age, gender, and body-mass index. Homogeneity of variances was examined using Levene's test. Pairwise comparisons between levels of tobacco consumption were made using ANCOVA, again adjusting for age, gender, and body-mass index. All analyses were performed using SPSS (version 8.0, SPSS,Inc).

RESULTS

Subjects

A total of 849 third-year students (462 males and 387 females) participated in the survey (*table 1*). The average participation in all years from 1989 to 2000 was 98.2% (range 95.3–100%). Seventeen students were excluded from the analyses either because of missing data on potential confounding variables, or based on the cross-validation of the questionnaires. The average age was 22 (standard deviation 2) years for both genders. The sample in which blood tests were performed included 697 students (386 males and 311 females).

Tobacco use

One hundred and fifty male (33.2%) and 108 female students (28.4%) were classified as current smokers (*table 2*). Approximately half of them (48.0% of males and 50.0% of females) smoked regularly 10 to 20 cigarettes per day (13 cigarettes/day on average). Almost 76% of both male and female smokers started smoking after the age of 18 (mean age 19). One-fifth of the 20-year-old medical students were smokers whereas the rate of smoking among 24-year-old students was 48.4%. No temporal difference was observed in the use of tobacco for the years 1989–2000.

Alcohol consumption

As many as 349 males (77.2%) and 220 females (58.0%) reported consuming alcohol on a regular basis (*table 2*). The average amount of alcohol consumed in a week was 92 g for males (range 10–862 g), and 48 g (range 10–280 g) for females. On average, both males and females reported tasting alcohol for the first time at the age of 13 years. As far as the co-consumption of tobacco and alcohol is concerned, 35.6% of the male and 34.7% of the female smokers consumed alcohol. Their mean consumption of alcohol was 139 g/week for the males and

Table 1 Number of students participating in the survey between 1989 and 1999

Academic year	Males	Females	Total
1989–1990	26	17	43
1990–1991	30	38	68
1991–1992	21	31	52
1992–1993	25	33	58
1993–1994	44	34	78
1994–1995	47	32	79
1995–1996	47	39	86
1996–1997	43	25	68
1997–1998	47	30	77
1998–1999	41	45	86
1998–1999[a]	49	36	85
1999–2000	42	27	69
Total	462	387	849

a: During 1998–1999 the Clinical Nutrition course was presented twice due to changes in the curriculum of the University of Crete Medical School.

279

67 g/week for the females. By contrast, the respective amounts for the non-smokers were 63 g/week for the male and 35 g/week for the female participants. Overall, 5% of the male drinkers consumed more than 280 g and 3.6% of the female drinkers consumed more than 140 g of alcohol weekly. No temporal difference was observed in the consumption of alcohol (1989–2000).

Serum lipid profile
Males had overall a worse serum lipid profile than females (*table 2*). Univariate analysis of lipid values stratified by smoking category showed significantly higher triglyceride and lower HDL-cholesterol levels compared with ex- or non-smokers (*table 3*). Although the mean values of total cholesterol, LDL-cholesterol, and the TC/HDL ratio were comparable between smokers and ex- or non-smokers, these markers were strongly correlated with the level of smoking (*table 4*). Conversely, neither the duration of smoking nor the drinking of alcohol was correlated with the serum lipid profile.

DISCUSSION
The main finding of this study is that the prevalence of smoking among Greek medical students in the University of Crete (33.2% for men and 28.4% for women) is one of the highest reported in the literature. Similar studies worldwide reported a prevalence of smoking among medical students ranging widely from 0 to 57% for males and from 0 to 45% for females.[1] In North America and Australia single percentage figures for both genders have been reported,[11] whereas in Asia and Africa the prevalence of smoking is significantly lower among female students, since smoking is considered as more socially unacceptable for women.[1] In

Europe tobacco use varies strongly among students in different medical schools. It would appear, however, that it is more prevalent among medical schools in Mediterranean countries,[12,13] a finding which might generally reflect the smoking habits of people of the same age in those countries. Nevertheless, compared to the figures for

Table 2 Tobacco use, alcohol consumption, and serum lipid profile in third-year medical students in the University of Crete

	Males[a]		Females[b]		
	N	%	N	%	p-value[c]
Non-smokers	267	59.1	249	65.5	
Ex-smokers	35	7.7	23	6.1	
Smokers	150	33.2	108	28.4	NS
1–9 cigs/day	55	36.7	38	35.2	
10–20 cigs/day	72	48.0	54	50.0	
>20 cigs/day	23	15.3	16	14.8	
Non-drinkers	103	22.8	160	42.0	
Drinkers	349	77.2	220	58.0	<0.001
Heavy drinkers[d]	18	5.2	8	3.6	
Total cholesterol (mmol/l)					
<5.2	286	74.0	238	76.5	
5.2–6.1	78	20.3	60	19.3	NS
≥6.2	22	5.7	13	4.2	
Triglycerides (mmol/l)					
<1.6	360	93.3	306	98.4	0.001
≥1.6	26	6.7	5	1.6	
HDL-C (mmol/l)					
<0.9	56	14.5	16	5.1	<0.001
≥0.9	330	85.5	295	94.9	
LDL-C (mmol/l)					
<3.4	263	68.1	234	75.2	
3.4–4.0	80	20.8	60	19.3	0.028
≥4.1	43	11.1	17	5.5	
TC/HDL-C ratio					
<4	217	56.2	246	79.1	<0.001
≥4	169	43.8	65	20.9	

a: N=452 for tobacco and alcohol consumption, N=380 for serum lipids and lipoproteins.
b: N=386 for tobacco and alcohol consumption, N=311 for serum lipids and lipoproteins.
c: Chi-square test.
d: Heavy drinking is defined as consumption of more than 280 g alcohol per week for males and 140 g per week for females.
NS: not significant

Table 3 Relationship between tobacco use and serum lipids and lipoproteins in University of Crete medical students

	Current smokers N=216		Non/ex-smokers N=481		
	Mean	(SE)	Mean	(SE)	p-value[a]
Total cholesterol (mmol/l)	5.40	(0.07)	5.36	(0.05)	NS
Triglycerides (mmol/l)	0.78	(0.03)	0.73	(0.01)	0.032
HDL-C (mmol/l)	1.27	(0.02)	1.33	(0.02)	0.037
LDL-C (mmol/l)	2.99	(0.06)	2.93	(0.04)	NS
TC/HDL-C ratio	3.9	(0.09)	3.7	(0.09)	NS

a: ANCOVA. Age, gender, and body-mass index were used as covariates.
NS: not significant

the prevalence of smoking in Greece,[4] the prevalence of smoking among medical students in our survey was considerably lower, but still unacceptably high.

It has been reported that substantial initiation of tobacco use occurs before adulthood.[14] This is in agreement with our findings, since almost one-fourth of our students started smoking before the age of 19 years. What is of equal concern though is that a significant percentage of third-year medical students still use tobacco. In this regard, their teaching in the medical school on the adverse effects of smoking should be considered as ineffective, a practice that may need to be reassessed based on these results. Additionally, and in view of the previous findings relating to the age of initiation of smoking, it would appear necessary to establish special anti-smoking programmes in high schools.

Such measures would be essential in view of the present findings of a high prevalence of abnormal lipid profiles at a young age, and also the relationship shown between the level of smoking and the progressively unfavourable changes in serum lipid profiles. Many studies have reported similar adverse changes in lipids associated with smoking.[15–17] It has been suggested that smoking even of short duration and quite moderate consumption of cigarettes is associated with adverse lipoprotein profiles.[18] It should be noted, however, that no student was symptomatic of cardiovascular disease at the time of the examination or had performed blood lipids measurements in the past. In this regard, the usefulness of a cholesterol screening test for adults aged 20 years or older remains controversial. Although the national cholesterol education programme in the USA recommends it,[19] there are researchers critical to this idea.[20] Others suggest that cholesterol screening in young adults should be limited to those with a family history of coronary disease or other factors that place them at high short-term cardiovascular risk.[21] Our results showed that a small but considerable percentage of students had abnormal lipoprotein levels. We therefore suggest that the first screening test for dyslipidemias should be performed between the ages of 20 and 25 years. Nevertheless, more studies are necessary to correlate serum lipids in students with dietary habits and physical exercise.

The percentage of Greek students not consuming alcohol on a regular basis (31.6%) is one of the highest reported in Europe.[2,22,23] In seven medical schools in Great Britain, 12% of the male and 7% of the female drinkers reported high-risk levels of consumption.[23] In our sample only a few individuals reported consuming excessive amounts of alcohol on a weekly basis. This is consistent with the observation that the incidence of alcoholism in Greece is also relatively low.[24] Studies have also demonstrated a significant association between alcohol drinking and tobacco use.[25] In this study, only one-third of the drinkers were smokers. Nevertheless, smokers who drank alcohol tended to consume twice as much alcohol when compared with non-smokers. The same finding has been previously reported for middle-aged men.[26]

Despite the importance of the findings of this study in terms of good long-term health, our results should be seen within the limitations of the survey regarding unavoidable recall bias. Such bias, if present, would be assumed to be greater for alcohol rather than tobacco consumption, since the questionnaire included more cross-validation questions for the latter as compared to the former variable. It should also be borne in mind that since the study was performed during the Clinical Nutrition course, students could have also been sensitized towards health issues and so underreported their inappropriate lifestyle habits.

In conclusion, this study underscores the need for the implementation of smoking prevention and health promotion programmes focusing on young adolescents in primary and secondary school. Moreover, it would be of great interest to reassess the prevalence of tobacco use, alcohol drinking and abnormal serum lipid profile among the participants of this study at the time of graduation or during the first year of their practice as physicians, with a view to documenting their approach to managing their patients in relation to smoking and drinking habits.

Table 4 Relationship between level of tobacco consumption and serum lipids and lipoproteins in University of Crete medical students

| | Daily cigarette consumption | | | | | | |
| | 1–9 N=75 | | 10–20 N=107 | | >20 N=34 | | |
	Mean	(SE)	Mean	(SE)	Mean	(SE)	p for trend[a]
Total cholesterol (mmol/l)	5.23	(0.11)[b]	5.37	(0.10)[c]	5.89	(0.18)[b,c]	0.006
Triglycerides (mmol/l)	0.80	(0.04)[b]	0.82	(0.04)	0.96	(0.07)[b]	NS
HDL-C (mmol/l)	1.22	(0.03)	1.29	(0.03)[c]	1.16	(0.05)[c]	NS
LDL-C (mmol/l)	2.89	(0.09)[b]	2.92	(0.09)[c]	3.45	(0.16)[b,c]	0.008
TC/HDL-C ratio	3.9	(0.14)[b]	3.8	(0.13)[c]	4.7	(0.23)[b,c]	0.006

a: ANCOVA. Age, gender, and body-mass index were used as covariates.
b: p=0.05 for the pairwise comparison >20 cigarettes/day versus 1–9 cigarettes/day (ANCOVA adjusting for age, gender, and body-mass index).
c: p=0.05 for the pairwise comparison >20 cigarettes/day versus 10–20 cigarettes/day (ANCOVA adjusting for age, gender, and body-mass index).
NS: not significant.

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