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Smoking and Impaired Lung Function in Students of Technical Vocational Schools in Greece

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Abstract

Introduction: *Smoking remains a major health issue, despite recent European legislation. Adolescents and young adults exhibit high smoking rates resulting in severe morbidity and mortality later in life. The purpose of this study was to determine socio-economic, demographic and environmental factors contributing to active smoking and deterioration of lung function in adolescents and young students of technical schools.*

Materials and methods: *The study sample comprised 265 students in technical vocational schools in Western Greece. The Global Youth Tobacco Survey tools were used to assess smoking habits in the study population.*

Results: *A percentage of 61.2% of the sample were male, with most of them aged 14-18 years. The rate of current smokers was as high as 81.1%. Smoking status, age, age of smoking start, poor accommodation and the number of cigarettes were identified as independent prognostic factors of PEF (% pred). Smokers and those in their late teens also had a lower FEV1 (% pred.).*

Discussion: *Young smokers in schools may have impaired respiratory function earlier in their life, therefore prompt interventions in high school education are justified.*

Keywords: *pulmonary function test; environmental factors; students; smoking; spirometry*

Introduction

Smoking remains a major health issue in Greece, despite recent European legislation and the latest anti-smoking campaign. Smoking prevalence is particularly high among youngsters. In all countries participating in the European school survey project on alcohol and other drugs (ESPAD) survey, between 1995 and 2019, ESPAD averages for cigarette use declined for lifetime use (68% to 42%), current use (33% to 20%) and daily use (20% to 10%), but "new data reveal high prevalence of e-cigarette smoking - 40% for lifetime use and 14% for last-month use". Boys are heavier smokers than girls in most countries [1, 2].

Smoking has been causative factor for cardiovascular diseases and chronic respiratory conditions, and especially Chronic Obstructive Pulmonary Disease (COPD). The decline of respiratory function in COPD is supposed to be the result of changes that occur over a course of more than a decade. Adult smokers show an reduction in pulmonary function tests, and it is known that a reduction in FEV1 (Forced Expiratory Volume in 1 sec) of 40-50 ml per year is expected, instead of the expected 15-20 ml per year in normal individuals [3]. Some studies, however, suggest that this decline may reach 80-100 ml per year in some smokers [4, 5]. Thus, although the rate of decline in FEV1 shows a marked variation between individuals, the impression that there are some who have an increased rate of decline in FEV1 may be correct. The natural course of COPD is characterized by a gradual decrease in lung function over time, as it can be measured by pulmonary function tests, resulting in reduced physical activity and the development of a degree of disability and a deterioration in quality of life. Spirometry is nowadays the main monitoring method of airway obstruction [6].

Smoking control in youth is a precaution measure for healthy mid-age people and reduced morbidity and mortality.

However, besides smoking, main environmental factors contributing to COPD are serious occupational exposure to dust and chemicals (vapors, irritants, smoke) at work and the pollution of the external or internal environment. The earlier and longer the influence of these factors is, the more intense their effect on respiratory function will be. A combination of factors account for respiratory function deterioration and finally COPD development. COPD is nowadays considered to be a multiorgan disease, and has gross effect on overall morbidity and mortality [7]. The investigation of environmental factors exerting their effect on young age may considerably contribute to COPD prevention.

The aim of this study was to determine the socio-economic, demographic and environmental factors contributing to active smoking and impaired lung function in adolescents and young adults studying in technical schools.

Materials and Methods

The study population included students from technical vocational schools in Western Greece. The research was conducted during the school years 2016-2017, 2017-2018, 2018-2019 in a population of 1800 students from 6 technical vocational schools in Western Greece. The research sample finally consisted of 265 students.

The students were informed by the teacher about the study as well as by their classmates through social networks. For the minor students the consent was given by their parents after detailed information was given, while adult students gave their consent themselves. The completion of the research questionnaire and spirometry were performed in the areas of leisure time activities of the students (eg sports facilities). The questionnaires were completed anonymously. All participants were subjected to spirometry. The same portable spirometer (Contec SP-10 Spirometer) was always used and the test was always performed by the same researcher. Students with known chronic diseases were excluded from the study.

Research Tool

The research questionnaire consisted of 2 parts: a) part related to the socio-demographic characteristics of the sample, b) the Global Youth Tobacco Survey (GYTS) questionnaire. The latter was the research tool of the Global Youth Tobacco Survey, which is an internationally recognized standard for the systematic monitoring of tobacco use by young people (13-15 years old), as well as all important indicators related to use of tobacco products. It includes the following topics: use of tobacco products (smoked and non-smoking), smoking cessation, passive smoking exposure, pro- and anti- smoking media advertisements, easy access to tobacco products and smoking knowledge and behaviors. The GYTS conducted in our country in 2013 from the National School of Public Health and Epidemiology Department of the University of Thessaly and 4,618 people participated in the survey with a response rate of 87.7% [8].

Statistics

Statistical analysis was performed with the statistical package SPSS 22.0. Descriptive and inferential analysis was applied. The descriptive data of the distributions (mean, median, standard deviation) were used. The normality of the distributions was checked by the Shapiro - Wilk test: the criterion value > 0.9 was considered indicative of a normal distribution approach and led to the application of parametric methods of analysis. Specifically, the t - test was used for two samples and the analysis of variance (ANOVA) for more, with post - hoc analysis (Bonferroni t-test). The correlations were performed with Pearson test, while qualitative variables were studied with test x 2. For the following four tables the continuity correction was used. For the multivariate analysis linear regression models were applied. Variables associated with respiratory function parameters (FEV1, PEF) in the univariate analysis at $p = 0.20$ were included in multivariate analysis. The level of statistical significance was set at $p = 0.05$.

Results

The 61.2% of the sample were male, most of them aged 14-18 years (72.4%). Regarding the educational level of their parents, 34.7% of the fathers and 33.3% of the mothers were university graduates; 58.9% and 58.1% of mothers were employed respectively. A total of 82.6% of the parents were married, while 53.2% of the families comprised up to 4 members. A percentage of 81.1% of the participants lived in a town and 76.2%

in an apartment, whereas 31.7% used firewood as the main heating medium, while electric heating and radiators accounted for 40% and 38.5% respectively (**Table 1**).

Table1. *Demographic characteristics of the sample.*

	N	%
Gender		
Male	103	38.9
Female	162	61.2
Total	265	100.0
Age		
14-16 years old	97	36.6
17-18 years old	95	35.8
19-20 years old	47	17.7
21-22 years old	26	9.8
Total	265	100.0
Place of residence		
Town	215	81.1
Village	6	2.3
Suburb	44	16.7
Total	265	100.0
Home		
Detached house	63	23.8
Studio	7	2.6
Apartment (two rooms)	92	34.7
Apartment (≥ 3 rooms)	103	38.9
Total	265	100.0
Heating		
Electricity	106	40.0
Oil (stove)	21	7,9
Oil (central heating)	102	38,5
Gas	19	7.2
Wood	84	31.7
Other	6	2.3

The percentage of smokers was quite high at 81.1%. More than 20 cigarettes (pack) per day were reported by 17.7%, while 34.7% of the participants had started smoking before reaching 14 years of age (**Table 2**). Peak expiratory flow (PEFR) and FEV1 were significantly reduced in smokers ($p < 0.001$) (**Table 3**).

Table2. *Smoking status of the participating students.*

	N	**%**
Current smoking		
Yes	215	81,1
No	50	18,9
Total	265	100,0
Number of cigarettes per day		

≤5	19	8,8
5-10	67	31,2
10-15	53	24,7
15-20	38	17,7
20-25	28	13,0
>25 cigarettes	10	4,7
Total	215	100,0
Smoking onset age		
≤14 years old	75	34,7
15	90	41,7
16	43	19,9
17	6	2,8
18	2	0,9
Total	216	100,0

Table3. *Pulmonary function baseline characteristics of the sample*

	Current Smokers (n=215)	Non-smokers (n=50)	p value
FEV1 (l)	3.02±0.49	3.16±0.44	0.073
FEV1%	89.95±11.73	110.10±11.12	<0.001
FVC (l)	3.46±0.76	3.65±0.82	0.108
FVC%	90.02±13.27	98.98±9.81	<0.001
FEV1/FVC	0.89±0.08	0.88±0.08	0.490
PEFR (l/min)	84.14±19.10	99.62±15.80	<0.001

Smoking, age group, age of smoking onset, living in a studio and the number of cigarettes were identified as independent prognostic factors of PEFR (% pred). Smokers, those who lived in studios, those who started smoking early, those who smoked more than 15 cigarettes a day, women and those in their late adolescence showed a worsening of PEF (**Table 4**). Smoking and the age group were independent prognostic factors for FEV1 (% pred). Smokers and those in their late teens also experienced a worsening of FEV1 (% pred.) (**Table 4**).

Table4. *Linear regression model for PEF and FEV1 (dependent variables) and smoking /demographic characteristics (independent variables)*

R^2=0,372	PEF (%pred)	FEV_1 (%pred)
	p	p
(constant)	<0.001	<0.001
Gender (woman)	**0.003**	-
Age group 14-16 years old	**0.006**	-
Age group 19-20 years old	-	**0.001**
Age group 21-22 years old	0.003	**0.006**
Home place (studio)	**0.022**	-
Smoking (NAI)	**<0.001**	**0.005**
Number of cigarettes	**0.004**	**-**
Smoking onset age	**0.030**	**-**

When exposure to tobacco was limited to less than 5 hours per day, men had a statistically higher PEF than women (6.28 ± 1.39 vs. 5.29 ± 0.95, p <0.001), a difference that disappeared, with a parallel reduction of PEF, in men. Men and women showed a significant difference in FEV1 relative to the average number of cigarettes: when the average number of cigarettes exceeded 15 per day, women experienced a further deterioration in FEV1 (2.82 ± 0.39 vs. 2.86. 0.37 and the difference with men increased (p <0.001).

DISCUSSION

According to the results of this study, the prevalence of smoking among students of technical vocational schools was very high, while there are early spirometry signs of respiratory function deterioration. Previous studies have not reached any definitive conclusions on the health of youngsters especially on smoking habits in relation to socio-demographic factors [9, 10]. The present study highlights the importance of the problem and the increased frequency of smoking in late adolescence and emphasizes the importance of early intervention at a sensitive age in order to avoid significant health problems in the future. To our knowledge, this is the first study conducted in technical vocational schools, a place where the frequency of smoking is expected to be particularly high, based on evidence from international studies and current trends in young people in Greece [11, 12].

There is little information on the role of gender and socioeconomic status on smoking in southern European countries. In a past study data from 4,370 men and 5,213 women aged 25 years and older were studied. Smoking was found inversely related to the level of education in men. Males with a higher level of education tend to be less likely to be smokers at a given age than those with primary education. This pattern appeared with slight differences between age groups. In women, there was a reverse trend: the higher the level of education, the higher the relative risk of starting smoking (relative risk = 4.6, 95% confidence interval: 3.1-6.7). The different effects of education depending on the gender may reflect different phases of the smoking epidemic. In Catalonia, where the study was conducted, the transition from smoking to higher and lower socioeconomic groups has recently occurred in men and women have begun to experience this transition [13].

Another previous study was based on data from a sample (12-17 years old, n = 5,053) of children and adolescents. Among boys, middle- and lower-educated adolescents were 2.7 times more likely to be smokers compared to highly educated peers. Among girls, those with low education had a 2.2-fold increased risk of smoking [14].

The (early) burden on smokers' respiratory function is reflected on respiratory tests and is associated with smoking habit. The decrease in FEV1 has been found to be directly related to the number of cigarettes smoked per day, with a worsening of FEV1 occurring among those who smoked more than 20-25 cigarettes/day, regardless of whether the duration of smoking it was 5 or 40 years [15, 16]. This shows the negative impact of smoking on a population in which the decline in lung function has just begun and in which the cumulative effects of smoking are yet minimal. In another study were involved 30 healthy people aged 19-23 years. The sample consisted of 20 smokers and 10 non-smokers. FVC, FEV1 and FEV1 % were found to be significantly lower in the smoker group: FVC and FEV1 (FEV1%) were found to be significantly lower in smokers compared to the non-smoker group (p <0.05). Decreased FEV1 is one of the first determinants of lung dysfunction in seemingly healthy smokers. Lack of lung function is associated with an increased risk of lung disease, heart disease, cancer and other diseases [17].

A study on 213 students and private university staff, healthy smokers and non-smokers, found that the mean FVC, FEV1, FEV1/FVC and PEFR were lower in smokers than in non-smokers, while there were significant differences between the mean spirometric values of smokers and non-smokers in the age groups 20-30 years and 30-39/40-49 years old. Living conditions contribute significantly to the further deterioration of respiratory function. In an older study was found that children living in homes in hot water heating systems without conditioning averaged FEV1 up to 0.4 liters lower than the respective individuals living in homes with forced air heating and air conditioning. Pets, heating systems, cooking fuels, overcrowding and passive smoking did not show a consistent association with any of the symptoms. The girls reported more wheezing and shortness of breath. The findings of the present study on the effect of living space on respiratory function confirms these findings.

The findings of the present study highlight the importance of the characteristics of the student-and their environmental factors. Indeed, intrinsic and objective characteristics of the student-smoker, such as gender, age of smoking onset, place of residence and age are strongly correlated with respiratory function. These factors are likely to account for the consolidation of the smoking habit and the consequent deterioration of their respiratory function. These results confirm previous findings showing that even young smokers have impaired respiratory function.

However, the small number of non-smokers involved, which probably indicates absolute lack of interest in anything that may be related to a habit completely indifferent to them, is a major limitation of the research and is probably responsible for overestimating the smoking prevalence. The sample comes from Western Greece and it is not representative and the conclusions, although indicative of trends, should be cautiously applied to the entire population of students of technical vocational schools in the country. In addition, the research tool did not include questions about the influence of peers, which seems to be sufficiently important and possibly stronger than the role of parents. The participants were mainly smokers, a fact that is a limitation of the study. Also, as a convenience sample, it cannot be considered representative of the whole population of technical vocational school students.

The novelty of the present study is that it focuses on students of technical vocational schools, where the data in Greece and internationally are very limited and highlights the early deterioration of respiratory function. Therefore, there are now strong indications justifying aggressive interventions with emphasis on the educational process and early detection of respiratory dysfunction, especially in this group of adolescents, in order to quit smoking as soon as possible. Smoking in childhood and adolescence has immediate and long-term health effects. The immediate negative health effects of smoking include addiction, reduced fitness/endurance and asthma, while early smoking increases the long-term risk of cardiovascular disease, respiratory disease and cancer. Children who smoke are also more likely to experiment with alcohol and illicit drugs. The magnitude of the problem of smoking in adolescents is such that it is considered a warning of an impending epidemic. Intervention programs focusing on modifying adolescent behavior should be implemented on a large scale. Students' educational level and socioeconomic factors may be related to the onset and consolidation of the smoking habit.

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