

The comparative analysis of amount of exhaled carbon monoxide as an indicator of smoking among students of selected universities in Wrocław

Analiza porównawcza ilości wydychanego tlenku węgla jako wskaźnika palenia tytoniu wśród wybranych studentów uczelni we Wrocławiu

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(b) Preparation of the questionnaire

(c) Data collection

(d) Statistical analysis

(e) Data interpretation

(f) Manuscript preparation

(g) Literature search

ABSTRACT

Background: The aim of this study is to compare the amount of exhaled carbon monoxide which can be an indicator of the phenomenon of tobacco smoking among youngsters in a group of students of Wrocław's universities. **Materials and methods:** The study was performed on 347 students living in dormitories of four Wrocław universities: Wrocław Medical University, University of Wrocław, University of Physical Education and Technical University. Every tested student underwent a measurement of quantities of exhaled carbon monoxide by a Micro Medical Smoke Check device. Every participant took part in an anonymous survey, which was divided into three parts (for smokers/non-smokers/ex-smokers) and included exposure to tobacco smoke, length of time smoking etc. **Results:** No difference in the amount of exhaled CO between students of particular universities was observed. The Smoke Check measurements are higher in actively smoking students compared to nonsmokers. The results are higher in students declaring passive smoking compared with those not exposed to tobacco smoke at all. No difference in level of CO between genders and particular age groups was observed. **Conclusions:** Despite

higher health awareness, students of the Medical University and University of Physical Education reach for cigarettes as often as the other tested students. Male students smoke as often as female students and CO result was not dependent on age.

Key words: Carbon monoxide, tobacco, health knowledge, smoking, students

STRESZCZENIE

Wstęp: Celem pracy jest porównanie ilości wydychanego tlenku węgla przez studentów wybranych uniwersytetów we Wrocławiu, jako wskaźnika pomocnego przy ocenie zjawiska palenia tytoniu u młodzieży studiującej. **Materiały i metody:** Badanie przeprowadzono wśród 347 studentów zamieszkujących domy studenckie czterech wrocławskich uczelni: Uniwersytetu Medycznego, Uniwersytetu Wrocławskiego, Akademii Wychowania Fizycznego i Politechniki Wrocławskiej. Zbadano ilość wydalanego tlenku węgla z użyciem urządzenia Micro Medical Smoke Check. Każdy uczestnik wziął udział z ankiecie dotyczącej jego kontaktu z dymem ty-

toniowym. **Wyniki:** Nie zaobserwowano różnic w ilości wydychanego CO między studentami różnych uczelni. Wyniki były najwyższe w grupie osób aktywnie palących. Grupa osób biernie palących wydalala więcej CO niż osoby nie deklarujące narażenia na dym tytoniowy. Nie zauważono różnic między grupą mężczyzn i kobiet, jak i między różnymi grupami wiekowymi. **Wnioski:** Pomimo większej świadomości zdrowotnej, studenci

Uniwersytetu Medycznego i Akademii Wychowania Fizycznego sięgają po papierosa częściej, niż pozostali. Kobiety okazały się palić równie często, jak mężczyźni. Nie zaobserwowano różnic w ilości wydalanego CO między płciami.

Słowa kluczowe: tlenek węgla, tabaka, świadomość zdrowotna, palenie papierosów, studenci

INTRODUCTION

Despite many anti-tobacco campaigns, smoking is the most prevalent addiction all over the world, affecting about one third of the human population [2]. Tobacco caused 100 million deaths in the 20th century. If those trends continue, it will lead to 1 billion deaths in the 21st century [1]. It is estimated that there are approximately 9 million tobacco-smokers in Poland, which represents 27% of the country's adult population [3]. Unfortunately, both active and passive smoking appear in a population of students living in student residences. Because of the studies' specific character, the medical and physical education, students should be aware of tobacco exposure consequences. Medical students' health awareness and habits are very important because potential physicians of the future they will have a significant influence on their tobacco consuming patients.

MATERIAL AND METHODS

The study involved 347 students (168 women and 179 men) of Wrocław Medical University (87 students – 25% of all participants), University of Wrocław (78/22%) University of Physical Education (83/24%) and Technical University (99/29% of all). Inclusion criteria were as follows: a) age: 19–29, b) be full-time programme student of particular university, c) living in student residence. Exclusion criteria comprised: a) age 18 years b) a lack of consent.

The study was performed in the last three months of the academic year so that students had had time to integrate into the college environment and educational systems. Every student underwent the measurement of quantity of carbon monoxide in exhaled air, using a Micro Medical Smoke Check device. The device detects both active and passive tobacco exposition. Before any measurements were taken, students were asked to fill out an anonymous questionnaire. The Smoke Check result was admin-

istered in one of four ranges: 0–6 ppm, 7–10 ppm, 11–20 ppm, 20 ppm and above, determining the number of molecules of carbon monoxide per million particles of exhaled air. The 0–6 ppm result and non-smoking declaration were considered as definitely tobacco smoke free condition; the 11–20 and 20 < ppm as definite indications of active smoking [4, 5]. The survey was divided into three parts for smokers, non-smokers, ex-smokers. It included: basic demographic data (gender, age, university), exposure to tobacco smoke, length of time smoking, questions about family presence of nicotine-dependent neoplasms. The Fagerstrom Test for Nicotine Dependence was also included, but it will be described in the next paper.

The Kolmogorov-Smirnov test was used to check the distributions against the normal distribution for all the tested quantitative variables. Continuous variables with a normal distribution were expressed as means \pm standard deviations of a mean (SD), those with a skewed distribution were expressed as medians with lower and upper quartiles. The comparisons of mean variables in two independent groups was made with the U Mann-Whitney test. To compare mean values for more than two groups, the Kruskal-Wallis test was used. A value of $p < 0.05$ was considered statistically significant. STATISTICA 10.0 (StatSoft) was used for statistical analyses. The study protocol was approved by the Bioethics Committee of the Medical University in Wrocław.

RESULTS

In the group of 347 students – according to the survey – 260 (75%) have never smoked, 20 (6%) were ex-smokers and 67 (19%) were daily smokers. The average age of participants was: $\bar{x} = 22.65$; $SD = 2.02$. The characteristics of the investigated group were presented in table I and II. Among non-smokers and ex-smokers, 122 (44%) students declared passive exposure to tobacco smoke. 204 (62%) participants were definitely nonsmokers (tab. I) another

59 (17%) were found as definitely users (tab. I). There was no difference in the amount of exhaled CO between students of particular universities: $p > 0.05$ (fig. 1, tab. I). The comparisons in the amount of exhaled CO between smokers contrasted with both nonsmokers and ex-smokers, passive and non-passive smokers were presented in figure 2 and

table II. There was no difference in the level of exhaled CO between men and women ($p > 0.05$) and between students with nicotine-dependent neoplasm presence in their families and students without neoplasm in their families ($p > 0.05$). No difference in CO measurements in particular age groups was observed ($p > 0.05$).

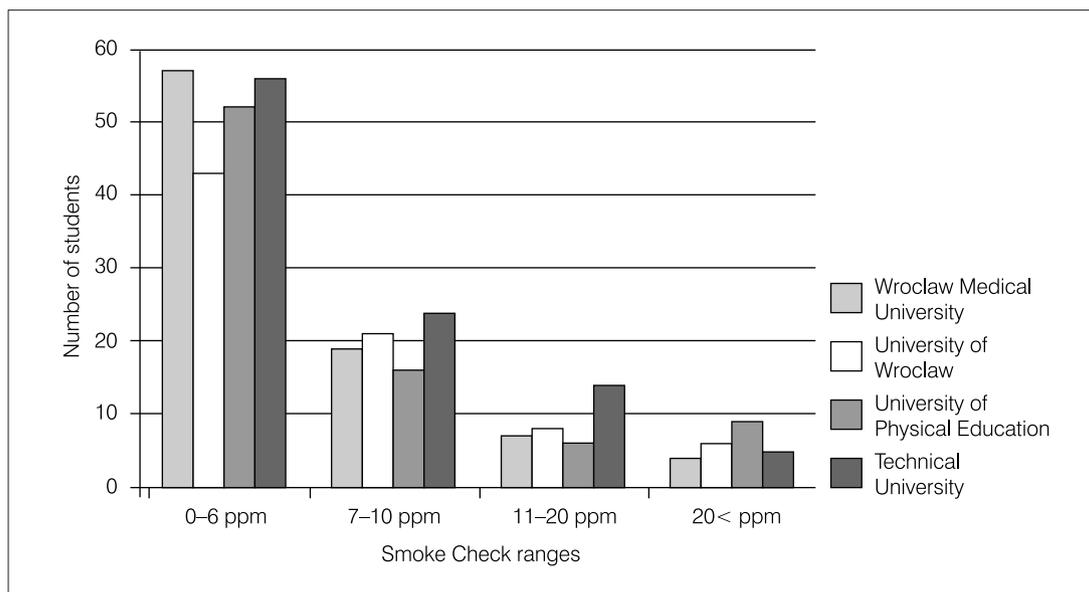


Figure 1. The students' number of particular universities at four Micro Medical Smoke Check ranges

Rycina 1. Liczba studentów poszczególnych uczelni Wrocławia z uwzględnieniem wyników badania urządzeniem Smoke Check

Table I. Detailed characteristics of the sample group at four exhaled CO ranges

Tabela I. Szczegółowa charakterystyka ilości wydychanego CO w badanej grupie

Characteristics		0-6 ppm	7-10 ppm	11-20 ppm	20 < ppm
Women	n (%)	104 (61.90)	43 (25.60)	15 (8.93)	6 (3.57)
Men	n (%)	104 (58.10)	37 (20.67)	20 (11.17)	18 (10.06)
Medical University of Wrocław	n (%)	57 (65.52)	19 (21.84)	7 (8.05)	4 (4.60)
University of Wrocław	n (%)	43 (55.13)	21 (26.92)	8 (10.26)	6 (7.69)
University of Physical Education	n (%)	52 (62.65)	16 (19.28)	6 (7.23)	9 (10.84)
Technical University	n (%)	56 (56.57)	24 (24.24)	14 (14.14)	5 (5.05)
Smokers	n (%)	4 (5.97)	16 (23.88)	23 (24.33) [^]	24 (35.82) [^]
Nonsmokers	n (%)	195 (75.00) [§]	54 (20.77)	11 (4.23) [^]	0 (0.00)
Ex-smokers	n (%)	9 (45.00) [§]	10 (50.00)	1 (5.00) [^]	0 (0.00)
Passive smoking - YES	n (%)	80 (65.57)	37 (30.33)	5 (4.10)	0 (0.00)
Passive smoking - NO	n (%)	124 (78.48)	27 (17.09)	7 (4.43)	0 (0.00)
nicotine-dependent cancer - YES	n (%)	40 (57.14)	17 (24.29)	6 (8.57)	7 (10.00)
nicotine-dependent cancer - NO	n (%)	168 (60.65)	63 (22.74)	29 (10.47)	17 (6.14)

§ - definitely nonsmokers (osoby z wynikiem potwierdzającym niepalenie)

^ - definite indications of active smoking (osoby z wynikiem potwierdzającym aktywne palenie)

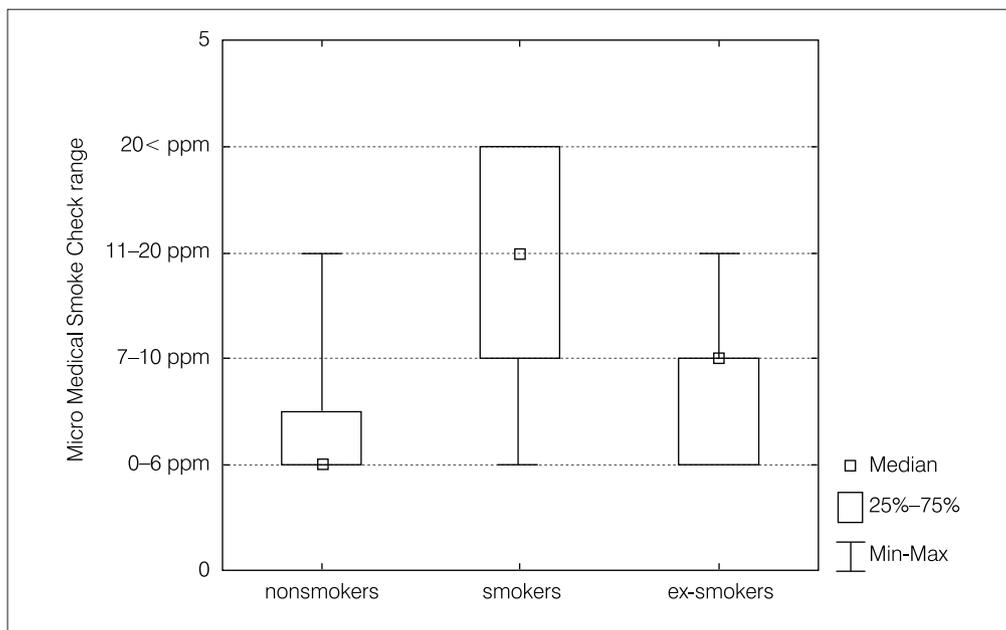


Figure 2. The association between Smoke Check measurements and declared students' smoking behavior
 Rycina 2. Zależność między wynikami badania urządzeniem Smoke Check a odpowiedziami studentów dotyczących palenia

Table II. Characteristics of sample group divided into smokers, nonsmoker, ex-smokers and comparisons between them
 Tabela II. Charakterystyka badanej grupy z uwzględnieniem podziału na palaczy, osoby niepalące i byłych palaczy

Characteristics n = 67	Smokers n = 260	Nonsmokers n = 20		Ex-smokers
		Passive smoking - NO	Passive smoking - YES	
Women	28 (16.67)	76 (45.24)	56 (33.33)	8 (4.76)
Men	39 (21.79)	71 (39.66)	57 (31.84)	12 (6.7)
Age; mean ± SD	22.46 ± 1.96	22.62 ± 2.06	22.70 ± 1.87	23.25 ± 2.67
Exhaled CO; range median [ppm]	11–20*	0–6°.#	0–6°.#	7–10°
Medical University of Wrocław	6 (6.90)	33 (37.93)	38 (43.68)	10 (11.49)
University of Wrocław	25 (32.05)	35 (44.87)	16 (20.51)	2 (2.56)
University of Physical Education	16 (19.28)	35 (42.17)	32 (38.55)	0 (0.00)
Technical University	20 (20.20)	44 (44.44)	27 (27.27)	8 (8.08)

* – p < 0.05 in comparisons between: smokers vs. both nonsmokers and ex-smokers (fig. 2);
 p < 0.05 w porównaniu pomiędzy palaczami i połączoną grupą niepalących i byłych palaczy
 ° – p < 0.05 in comparisons between: passive smokers vs. non-passive smokers in both groups: nonsmokers and ex-smokers;
 p < 0.05 w porównaniu pomiędzy pasywnymi palaczami osobami nie palącymi biernie. w grupach niepalaczy i byłych palaczy
 # – p < 0.05 in comparisons between: passive smokers vs. non-passive smokers. but only in group of nonsmokers (without ex-smokers).
 p < 0.05 w porównaniu między biernymi palaczami i osobami nie palącymi biernie. tylko w grupie osób nie palących nigdy aktywnie

DISCUSSION

Tobacco kills up to 50% of its users and there is no safe level of exposure to second-hand tobacco smoking [1]. Much emphasis is placed on anti-to-

bacco education all over the world. Though the increased health awareness, students of the Medical University and University of Physical Education reach for cigarettes as often as the other students who took part in the study (Fig. 1, Tab. I, II), which

corresponds with other papers [6, 7]. This shows, that the knowledge about negative consequences of smoking is not good enough reason to non-smoking at all. It is known, that the attitude of future medical physicians will have influence on success in quitting therapy and prevention smoking-related diseases [4], so what should the health policy look like?

The authors have considered smoking as the only factor of increased CO level in exhaled air [9, 10]. It is known that smokers sometimes make know untrue information about their smoking status, because of this individual declarations should be confirmed by objective study [2, 4], which can be done by Micro Medical Smoke Check device, as a fast, easy and non-invasive method of indicating smoking prevalence [4]. Not all declared tobacco addiction statements are true, according to Pirogowicz & et al [11] some women, who smoked during pregnancy provided false information about their smoking habits. There is a statistically significant increased level of CO in the sample exposed (active and passive) to tobacco smoke against the sample of non- and ex-smokers (fig 2, tab. II). This corresponds with other studies [2, 10] and confirms a smokelyzer's efficacy of describing smoking status in population. Statistically, female students smoked as often as male students and CO result was not dependent on student's age. The outcome of the survey is certainly not a surprise and is considered by authors, to clearly determine the current state of smoke addiction among students.

CONCLUSIONS

Despite higher health awareness, students of the Medical University and University of Physical Education smoke as often as the other tested students. The CO result was not dependent on age. Female students smoke as often as male students. The smoking-related behaviour in group of students with a nicotine-dependent neoplasm presence in their families compared to students without family burden was the same, even if disease had occurred.

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