
I Katedra i Klinika Chorób Wewnętrznych. Akademia Medyczna w Lublinie
Kierownik: prof. dr hab. n. med. Janusz A. Hanzlik
Zakład Biochemii Klinicznej i Toksykologii Środowiska. Akademia Medyczna w Lublinie
Kierownik: prof. dr hab. n. med. Jeremiasz J. Tomaszewski

Wojciech BARUD, Stanisław OSTROWSKI, Anna WOJNICZ,
Janusz A. HANZLIK, Barbara SAMULAK,
Jeremiasz J. TOMASZEWSKI

Evaluation of Lung Function in Male Population from Vocational Mining Schools of the Lublin Coal Basin*

Ocena stanu czynnościowego układu oddechowego uczniów zasadniczych szkół górniczych
Lubelskiego Zagłębia Węglowego

Occupational exposure to dust and other environmental factors in coal miners may impair the lung function of workers. Besides the coal workers' pneumoconiosis, the inhalatory dust may cause decreased ventilatory capacity as a due to chronic bronchitis (9, 13). The same diseases, especially chronic bronchitis, are common in general population and may arise not only from occupational reasons (11, 12). The involvement of the genetic factors, environmental pollutions and cigarette smoking should be considered.

It seems obvious that the influence of mining environment on the bronchopulmonary system of miners also depends on the initial lung function status of men beginning underground work in coal mine. The aim of the present study was to evaluate the lung function of young males beginning training in the miners vocational schools of the Lublin coal area. We assume that collected data make possible:

- 1) to eliminate the persons with evident or endangering bronchopulmonary malfunction from underground work;
- 2) to elaborate and introduce the preventive program improving respiratory conditions (nonsmoking, physical activity) to vocational schools practice;
- 3) to evaluate the real influence of occupational conditions in Lublin coal mines on the health status of miners in the follow-up study.

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MATERIAL AND METHODS

In 1986 and 1987, 893 boys 14–17 years of age beginning training in vocational mining schools at Chelm, Lublin, Ostrów and Piaski were examined. This examination included collecting of some demographic data, medical history and smoking habits. The height (without shoes) was measured exact to 1 cm, and the weight (in light clothes) exact to 0.5 kg. Spirometric examination was performed before and after metacholine test according to Hoffarth et al. (6). The 0.2% solution of metacholine was used for inhalation. It was applied for 1 min using US inhalator (Tur, GDR). Forced vital capacity (FVC) and forced 1-second expiratory volume (FEV_1) before and 2 min after inhalation were measured by Eutest apparatus (Medicor, Hungary), according to Droszcz et al. 2).

On the basis of the measured data FEV_1 of FVC percentage ($FEV_1\%FVC$), Ziemsen index (FVC/height) and Amar index (FVC/weight) were calculated. Statistical analyses of the results were done on an IBM PC/XT computer using the SPSS/PC statistical package.

RESULTS

The mean values of the examined parameters in the whole school-students population and in groups divided according to age are summarized in Table 1. The absolute forced vital capacity and forced 1-second expiratory volume are increasing in the successive age groups. It depends mainly on the physical development represented by the boys' height. As it can be seen in Fig. 1, there is a significant correlation between FVC and FEV_1 and the height of students, and also significant, but much lower one between FVC and FEV_1 and the age of the subjects ($r = 0.195$ and $r = 0.181$, respectively). The results of metacholine test are presented in Table 2. In the whole group over 10% decrease of FEV_1 after administering metacholine was observed in 25.1% of the boys. In 54 students (6%), a decrease of FEV_1 over 20% after metacholine test was stated. Although the decrease of FEV_1 after metacholine is only a relative index of bronchial system hyperreactivity, it proves that in this group the subjects with some risk factors of lung function impairment may be found.

It is surprising and distressing that in the population of mean age 15.4 years as many as 15.1% smoke constantly (above 1 cigarette per day). Although at the moment there are no differences in the examined lung function parameters between smokers and non-smokers groups, as it can be seen from Table 3,

Table 1. Age, height, body weight and spirometric indices in boys from miners vocational schools of the Lublin Coal Basin (mean \pm SD)

Age years	N	Height cm	Weight kg	FVC l	FEV_1 l	$FEV_1\%FVC$ %	Ziemsen index	Amar index
14	8	160.4 \pm 8.1	47.3 \pm 5.2	3.3 \pm 0.5	2.8 \pm 0.7	85.3 \pm 10.3	2051 \pm 234	6990 \pm 743
15	651	167.9 \pm 7.0	57.8 \pm 8.9	4.0 \pm 0.6	3.4 \pm 0.6	85.0 \pm 6.7	2362 \pm 321	6912 \pm 803
16	204	170.9 \pm 7.4	61.3 \pm 8.4	4.2 \pm 0.6	3.6 \pm 0.5	84.8 \pm 6.2	2483 \pm 320	6959 \pm 733
17	30	171.9 \pm 7.1	62.5 \pm 7.7	4.3 \pm 0.7	3.6 \pm 0.6	84.6 \pm 6.8	2493 \pm 337	6883 \pm 782
T	893	168.9 \pm 7.2	58.7 \pm 9.9	4.0 \pm 0.7	3.4 \pm 0.6	84.9 \pm 6.6	2391 \pm 326	6922 \pm 785

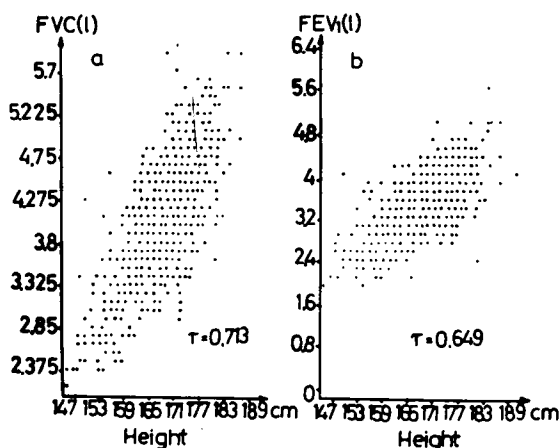


Fig. 1. Relationship between a — FVC and b — FEV₁ and body height of the students from mining vocational schools of the Lublin Coal Basin

Table 2. Hyperreactivity of the bronchial tree to metacholine inhalation in boys group from miners vocational schools of the Lublin Coal Basin

Age years	Percentage decrease of FEV ₁ after metacholine test					
	> 10%		> 15%		> 20%	
	N	%	N	%	N	%
14	2	25.0	2	25.0	1	12.5
15	166	25.5	79	12.1	37	5.7
16	49	24.0	25	12.3	13	6.4
17	7	23.3	3	10.0	3	10.0
Total	224	25.1	109	12.3	54	6.0

starting smoking at such a young age undoubtedly establishes an additional risk, not only for bronchopulmonary function.

DISCUSSION

On the whole, the mean values of the lung function parameters in vocational mining schools students are normal and characteristic of a given sex and age. Nevertheless, the forced vital capacity and forced 1-second expiratory volume in this population are little lower than in the boys from vocational schools in the Warsaw area (10), and also lower than in the boys from vocational mining school in Bełchatów (1). There may be two reasons for this situation. On one side the youth from the other regions, especially of Warsaw, show a little better physical development parameters (height and weight), which can cause greater lung volumetric indices. On the other hand, the higher FVC and FEV₁ at the same

Table 3. Spirometric indices (mean \pm SD) and bronchial reactivity to metacholine (in % of boys) between non-smoking and smoking groups

Parameters	Non-smokers	Smokers
N	758 (84.9%)	135 (15.1%)
Age (years)	15.3 \pm 0.5	15.5 \pm 0.6
Height (cm)	168.2 \pm 7.2	171.4 \pm 6.8
FVC (l)	4.00 \pm 0.66	4.28 \pm 0.60
FEV ₁ (l)	3.40 \pm 0.56	3.60 \pm 0.52
FEV ₁ % FVC%	85.1 \pm 6.7	84.1 \pm 6.4
Decrease of FEV ₁ > 10% (after metacholine)	22.7	22.8

anthropometric parameters may be dependent on some adaptive processes extorted by growing atmospheric air pollution. This hypothesis is supported by the fact that there are greater Zimens and Amar indexes in young males from upper Silesia, with high dust concentration, than from other cleaner regions (8). It is worth mentioning that nearly 64% of our students are of rural origin, with rather good ecological conditions.

The separate attention needs to be paid to rather high percentage of boys with bronchial hyperreactivity detected in our study. In other investigations of local working groups (3, 4) a lower number of the positive histamine test results have been observed. These differences may depend on method modification — the metacholine test is probably more sensitive than the histamine one. Nevertheless, the growing susceptibility to environmental allergens in young population should be also considered.

As it was mentioned before, a large number of our students are smoking. Taking into account a short time of smoking and rather low number of cigarettes per day, the same results of examination in non-smoking and smoking groups seem to be obvious. However, it is known from the other study (7) that smoking is one of important risk factors for impaired respiratory function. It seems obvious that smoking in students, reaching above 70% in adult miners (5), is one of the main health problems in Polish population.

Conclusions

1. Forced vital capacity and forced 1-second expiratory volume of students showed a significant correlation with height and also with age.
2. The spirometric lung function parameters in students of vocational mining schools of the Lublin Coal Basin are a little worse than those of youth from other regions of Poland.
3. On the basis of metacholine test results more cases of bronchial hyperreactivity than in other young populations were detected.

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STRESZCZENIE

U 893 uczniów zasadniczych szkół górniczych Lubelskiego Zagłębia Węglowego, w wieku 14—17 lat, mierzono wysokość i masę ciała oraz wykonano badania spirometryczne, obejmujące pomiar natężonej pojemności życiowej i natężonej 1-sekundowej objętości wydechowej przed i po teście inhalacyjnym z metacholiną. Stwierdzono wysoką korelację oznaczanych parametrów oddechowych ze wzrostem badanych, natomiast nieco niższą korelację z wiekiem. Średnie wartości FVC i FEV₁ w całej populacji oraz w grupach podzielonych według wieku okazały się nieco niższe niż u młodzieży z innych regionów Polski. Wśród badanych stwierdzono stosunkowo dużą liczbę przypadków nadwrażliwości drzewa oskrzelowego w teście z metacholiną. Za niepokojący należy uznać fakt, iż wśród chłopców w wieku 14—17 lat ok. 15% stale pali papierosy.

