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## Indices of External Respiratory Function Among Students

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**ABSTRACT.** External respiratory function of practically healthy students of both sexes in the age interval from 18 to 21 years was studied. Reduction in major indices of external respiratory function in comparison with the proper values regardless of gender and smoking was revealed.

**Keywords:** external respiration; vital capacity of lungs; smoking; spirometry; forced expiratory flow; students.

**INTRODUCTION.** Analysis of the scientific literature devoted to the problem of student health shows that in recent years the health of university students as well as all young people in general has deteriorated [1, 2, 3]. According to data of some researchers by the second year the number of disease cases increases by 23 % and by the fourth year – by 43 % [4, 5]. About 40 % of the entrants at the moment of matriculation already have problems with health, and many of them at least once a year suffer from acute respiratory infections. In the process of education in the university student organism is affected by a number of factors: physical inactivity, hypoxia, temperature factors, psycho-emotional effects, etc. Respiratory system, which is the most reactive, is the most open to contact with adverse environmental factors since it can not be protected from the external environment with reliable artificial barrier [6]. In studies devoted to the effects of environmental factors on the respiratory system, a large number of works focuses on air pollution by tobacco smoke. It was found [7, 8] that smoking adversely affects all physiological systems of the human organism and especially the respiratory. Many studies indicate that the respiratory function of the organism of young people does not meet the age and sexual parameters because the current generation from early childhood does not develop physically, and along with it, the respiratory system does not develop too [1, 9, 10].

In view of the foregoing, the purpose of the study was to investigate the functional state of the external respiratory system of practically healthy students living in the industrial region.

**MATERIALS AND METHODS.** The studies were conducted at the Department of Physiology of Biology and Geography Faculty of academician E.A. Buketov Karaganda State University. The study involved 57 students aged from 18 to 21 living in the industrial region. 24 of them male students, 33 female students. Among studied male students the number of smokers with experience ranging from 0,5 to 5 years was 12 persons. Anthropometric studies have been

conducted in the above groups of students: weight, height, blood pressure, heart rate, chest, breathing frequency was measured.

The functional state of the lungs was determined using a portable microprocessor-based spiograph (NSC – 21/01 – «R – D»), the device executing measurement and calculation of 26 indicators of external respiration and shaping the final examination protocol.

Spirometry tests were made in the following sequence: quiet breathing – up to 3–5 minutes, VC probe (at least 3 times) and FVC test (at least 3 times).

Implementation and evaluation of results of the study of external respiration were based on the recommendations of the European Respiratory Society and the American Thoracic Society [11]. Statistical analysis of the received data was carried out on a personal computer using the Excel.

**DISCUSSION.** Investigation of indicators of external respiratory function of practically healthy male and female students showed that the average vital capacity of lungs (VC) among girls and boys was significantly ( $p \leq 0,05$ ) lower than the average adequate, and was 62.3 % and 67 % to appropriate accordingly.

In the study of forced vital capacity (FVC) we found that among girls actual FVC was 66.6 % to the appropriate ( $p \leq 0,05$ ) (figure). Among young men the actual FVC was 71 % to appropriate.

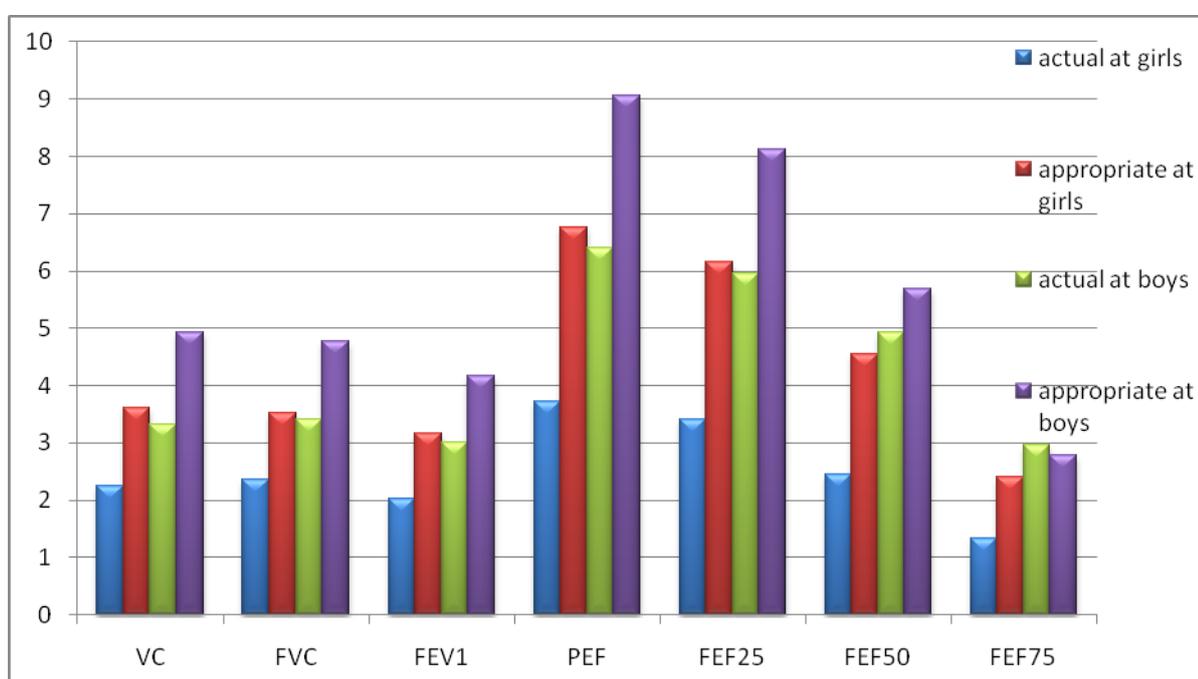


Figure: The diagram of indicators of external respiratory function among young people depending on sex.

The actual value of forced expiratory volume in 1 sec (FEV1) among girls was 63,7 % ( $p \leq 0,05$ ), among young men was 72 % to the appropriate ( $p \leq 0,05$ ), that is typical for moderate and mild degree of obstructive disorders. In the calculation index Tiffeneau we found that among girls the actual value of FEV1/VC was 101,7 % to adequate, among young men actual value of Index Tiffeneau was 107 % to adequate ( $p \leq 0,05$ ). In the diagnosis of extrathoracic airway obstruction peak expiratory flow (PEF) and forced expiratory flow at 25-27 (FEF 25–75) are significant. Actual PEF was 55,1 % to appropriate among girls ( $p \leq 0,01$ ). Among young men actual PEF – 70 % to appropriate ( $p \leq 0,01$ ).

In our studies the largest changes of actual FEF 25 – 55,4 % and FEF 50–53 % to appropriate were found at girls. Among boys there were significant differences in terms of FEF 25 to adequate.

The most significant parameter in the diagnosis of obstructive disorders, describing the speed of the air stream in the normal diameter of the bronchi, is the relation FEV1/VC. At the surveyed students this parameter did not have deviations from the adequate values. Along with this,

reduction of VC, FVC, PEF, FEF50-75 expressed among girls, allows to suggest the presence of mild and moderate degree of obstruction in the bronchi of small and medium caliber.

At smoking male students the actual VC made up 72 % to appropriate ( $p \leq 0,05$ ) (table), that is regarded as a moderate deviation. The difference of VC index between control and experimental group is insignificant.

№	Indicators	The control group (non-smokers)		The experimental group (smokers)	
		Actual indices	Appropriate indicators	Actual indices	Appropriate indicators
		M ± m	M ± m	M ± m	M ± m
1	VC	3,33±0,58*	4,92±0,28*	3,55±0,8*	4,93±0,23*
2	FVC	3,41±0,77	4,78±0,27	3,75±0,99	4,78±0,24
3	FEV1	3,01±0,95*	4,16±0,19*	2,83±1,08*	4,16±0,19*
4	FEV1%VC	91,77±27,3*	85,18±1,00*	90,53±29,87*	85,02±0,68*
5	PEF	6,41±2,42*	9,05±0,4**	5,53±1,27*	9,06±0,33**
6	FEF25	5,95±2,32*	8,12±0,41*	4,91±1,05**	8,13±0,34**
7	FEF50	4,92±2,44	5,69±0,28	4,49±1,35	5,69±0,22
8	FEF75	2,97±2,1	2,78±0,11	3,09±1,27	2,78±0,13
9	MEF25-75	4,48±2,36	4,92±0,19	4,2±1,28	4,92±0,18
10	FEV1/FVC	88%	88%	75%	87%
11	ERV	0,71±0,48		0,87±0,58	
12	IRV	1,26±1,03		1,57±1,01	
13	TVLVV	0,8±0,51		0,8±0,49	
14	RR	14,22±4,17		15,00±3,86	
15	LVV	10,96±6,35		11,53±6,63	

Table: Indicators of respiratory function at young people with harmful habits (smoking).

Note: \* differences are significant ( $P < 0,01$ )

Actual FVC at smoking students made up 78 % to appropriate. In comparison with the control significant differences were not found. In the calculation of FEV1 we found that the actual FEV1 at smoking boys was 68% to appropriate ( $p \leq 0,05$ ), that is regarded as a moderate deviation from the norm. In the control FEV1 was significantly higher than in the experimental group.

Thus, the main reason of decrease in external respiratory function parameters of practically healthy young people in carrying out tests of vital capacity and forced vital capacity, apparently, is the general asthenia of the organism caused by environmental factors, susceptibility to physical inactivity, low motivation to physical training and sports, and smoking.

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**Аннотация.** Исследована функция внешнего дыхания у практически здоровых студентов мужского и женского пола в возрастном промежутке от 18 до 21 года. Выявлено снижение основных показателей функции внешнего дыхания по сравнению с должными величинами независимо от пола и курения.

**Ключевые слова:** внешнее дыхание; жизненная емкость легких; курение; спирография; максимальная объемная скорость; студенты.