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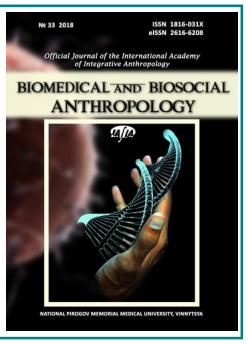

Age peculiarities of spirometric indices within the juvenile period of ontogenesis

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In the modern world, there are many causes (reducing the elasticity of the lungs, reducing bronchial tubes, reducing the strength of the respiratory muscles) that affect the parameters of external respiration. Knowledge of age, sexual and regional features of spirometric indicators helps to differentiate and detect the degree of disturbance of respiratory biomechanics and to choose effective treatments that are most appropriate for established violations. The purpose of the work is to establish the age-old peculiarities of the spirographic indexes of virtually healthy young men and women within the juvenile period of ontogenesis. We conducted a survey of 141 young women (from 16 to 20 years of age) and 154 young men (from 17 to 21 years) of adolescence. The spirographic study was conducted according to the generally accepted methodology of the American Association of Pulmonologists adopted in 1994 on the device Medgraphics Pulmonary Function System 1070 series. The analysis of the obtained results was carried out with the help of the license program "Statistica 5.5" using nonparametric methods of estimating indicators. The progressive age dynamics of the vital capacity, forced vital capacity, forced capacity of the lungs on the inhalation, volume exhalation velocity was detected in young women in 25% and 50% respectively of the forced vital capacity, the average expiration flow, the residual volume of exhalation and the forced inspiratory flow, respectively is 50% of exhalation from the forced vital capacity. In the last year (20 years) of the youthful period of ontogenesis in young women, the maximum arbitrary ventilation of the lungs is increased, the volume exhalation rate is 75%, and from 75% to 85% of exhalation from the forced vital capacity, the one-second volume of forced exhalation and maximal peak flow of exhalation. Within the juvenile period of ontogenesis in young men, the vital capacity of the lungs increases, the maximum arbitrary ventilation of the lungs and the maximum peak flow of exhalation. Only in the last year of the youthful period of ontogeny (21 years) in young men there is an increase in forced vital capacity, volume exhalation velocity, respectively, in 25% of the forced vital capacity, the residual volume of exhalation, one-second volume of forced exhalation was observed at the end.

Keywords: *spirometry, spirometric indices, young men, young women.*

Introduction

The widespread occurrence of bronchopulmonary diseases, their growth in recent decades makes it necessary for a wider introduction of methods for studying the respiratory system [6, 11, 12]. There are many factors in Ukraine and in other countries of the modern world (tobacco smoking, harmful working conditions, ecological situation, infectious diseases of the respiratory system, congenital anomalies of the lungs, etc.) that affect the reduction of the elasticity of the lungs, reduce the bronchial patency and strength of the respiratory muscles, which respectively affects the parameters of external respiration [4, 19].

Early detection of violations of respiratory biomechanics, dynamic observation of patients, the choice of treatment methods that best fit established violations, provide modern effective therapy. The widespread introduction of computerized devices, the rejection of the use of simple mechanical devices in recent years have both positive and negative sides. Sometimes there is the effect of a "black box" when the one who conducts a diagnostic study and evaluates its results does not fully understand their

diagnostic value. This situation arises in cases where the researcher does not take into account age, gender, constitution, bad habits, occupation of certain sports, lifestyle and other factors. This inevitably devaluates the study, leads to gross diagnostic and tactical errors, which are often observed in scientific and practical research [21].

Spirometry is the most common method of diagnosing the functional state of the lungs, as well as the detection of respiratory diseases [5, 8, 9]. Spirometry is a gold standard for the diagnosis of chronic obstructive pulmonary diseases [14], which worldwide have high prevalence, morbidity and mortality and create significant health problems [13].

Unlike laboratory tests that have fixed indicators of norm in young men and young women of a particular population, for spirometry, such indicators have been poorly studied [7]. Therefore, the establishment of standard parameters of spirography (volumetric, velocity and pulmonary ventilation) in healthy young men and young women within the juvenile period of ontogenesis is extremely important.

The *purpose* of the work is to establish the age-old peculiarities of the spirographic indexes of practically healthy young men and women within the juvenile period of ontogenesis.

Materials and methods

Together with the team of performers of the planned general-university scientific theme "Development of normative criteria of health of various age and sex groups", on the basis of the research center of the National Pirogov Memorial Medical University, Vinnytsya as a result of a comprehensive survey were selected adolescence, practically healthy young men and young women, urban population, who in the third generation live in the Podillia region of Ukraine.

The spirographic study was conducted according to the generally accepted methodology of the American Thoracic Society, adopted in 1994 [3] on the device Medgraphics Pulmonary Function System 1070 series.

A spirographic study of 141 young women was conducted, of which: 16 years old - 32; 17 years old - 29; 18 years old - 27; 19 years old - 25; 20 years old - 28 people; and 154 young men among them: 17-year-olds - 28; 18 years old - 37; 19 years old - 27; 20 years old - 32; 21-year-old 30 people.

The analysis of the obtained results was carried out with the help of the license program "Statistica 5.5" using nonparametric methods of estimating the indicators.

Results

It was established that the vital capacity of lungs in 16-year-old young women is 3.813 ± 0.687 L, at 17 years old - 3.980 ± 0.762 L, at 18 years old - 4.011 ± 0.536 L, at 19 years - 4.130 ± 0.628 L, in 20-year-olds - 4.305 ± 0.675 L. The value of this spirographic index is significantly higher in 20-year-old young women than in 16-year-olds ($p < 0.01$) and in 19-year-olds compared with 16-year-olds ($p < 0.05$) in the female population. The magnitude of the vital capacity is also significantly higher in 20-year-old young women compared to 17-year-olds ($p < 0.05$) young women.

The rate of forced vital capacity in 16-year-old young women is 3.541 ± 0.552 L, at 17 years old - 3.715 ± 0.619 L, at 18 years old - 3.723 ± 0.696 L, at 19 years old - 3.895 ± 0.674 L, at 20 years old - 4.005 ± 0.734 L. The value of this indicator of spirography is significantly higher in 20-year-old young women than in 16-year-olds ($p < 0.05$) and in 19-year-olds compared to 16-year-olds ($p < 0.05$) females.

Indicator of forced capacity of the lungs on the inspiration in 16-year-old young women is 2.636 ± 0.768 L, at 17 years old - 2.685 ± 0.672 L, at 18 years old - 2.761 ± 0.788 L, at 19 years old - 2.921 ± 0.633 L, in 20-year-old - 2.462 ± 0.663 L. The value of this spirographic index is significantly higher only in 19-year-old young women compared to 20-year-olds ($p < 0.05$) females.

The rate of maximum free ventilation in 16-year-old young women is 110.0 ± 21.6 L/min, at 17 years of age - 100.0 ± 19.9 L/min, at the age of 18 years - 105.9 ± 21.3 L/min, at the age of 19 years - 104.0 ± 28.3 L/min, at 20 years old - 121.8 ± 23.5 L/min. The value of this spirographic index is significantly higher in 20-year-old young women than in 16-year-olds ($p < 0.01$), 17-year-olds ($p < 0.001$), 18-year-olds ($p < 0.05$), and 19-year-olds ($p < 0.05$) females.

The indicator of volumetric exhalation velocity, correspondingly, in 25% of the forced vital capacity in 16-year-old young women is 5.947 ± 1.423 L/s, at 17 years of age - 5.775 ± 0.847 L/s, at 18 years of age - 5.348 ± 1.181 L/s, at 19 years - 6.285 ± 1.299 L/s, at 20 years old - 6.906 ± 1.544 L/s. The size of this spirographic index is statistically significantly higher in 20-year-old young women than in 16-year-olds ($p < 0.05$), 17-year-olds ($p < 0.01$), and 18-year-olds ($p < 0.001$) females. Also, the indicator of volume exhaust velocity, correspondingly, in 25% of the forced vital capacity is significantly higher in 19-year-old young women than in the 18-year-olds ($p < 0.05$).

The indicator of volume exhaust velocity, correspondingly, in 50% of the forced vital capacity in 16-year-old young women is 4.338 ± 1.053 L/s, at 17 years - 4.213 ± 0.956 L/s, at 18 years of age - 3.685 ± 0.986 L/s, at 19 years - 4.438 ± 1.332 L/s, at 20 years - 5.030 ± 1.344 L/s. The size of this spirographic index is statistically significantly higher in 20-year-old young women than in 16-year-olds ($p < 0.05$), 17-year-olds ($p < 0.01$), and 18-year-olds ($p < 0.001$) females. Also, the expiratory volume index of 50% of the forced vital capacity is significantly higher in 19-year-old young women than in 18-year-olds ($p < 0.05$) and is significantly higher in 16-year-olds compared to 18-year-old young women ($p < 0.05$).

Indicator of volume exhaust velocity, corresponding to 75% of the forced vital capacity in 16-year-old young women, is 2.372 ± 0.752 L/s, at 17 years of age - 2.203 ± 0.701 L/s, at 18 years old - 2.052 ± 0.724 L/s, at 19 years old - 2.355 ± 0.856 L/s, at 20 years old - 2.678 ± 0.704 L/s. The value of this spirographic index is statistically significantly higher in

20-year-old young women only compared to 17-year-olds (p <0.05) and 18-year-olds (p <0.01) females.

The indicator of volume exhalation rate from 75% to 85% of exhalation from forced vital capacity in 16-year-old young women is 1.948 ± 0.719 L/s, at 17 years of age - 1.675 ± 0.619 L/s, at 18 years of age - 1.684 ± 0.604 L/s, at 19 years - 1.870 ± 0.758 L/s, at 20 years - 2.107 ± 0.697 L/s. The value of this spirographic index is significantly higher in 20-year-old young women only compared to 17-year-olds (p <0.05) and 18-year-olds (p <0.05) females.

The average expiratory flow rate in 16-year-old young women is 3.784 ± 1.103 L/s, at 17 years old - 3.701 ± 0.982 l/s, at 18 years old - 3.349 ± 0.953 L/s, at 19 years old - 3.997 ± 1.173 L/s, at 20 years - 4.500 ± 1.161 L/s. The value of this spirographic index is significantly higher in 20-year-old young women than in 16-year-olds (p <0.05), 17-year-olds (p <0.01), and 18-year-olds (p <0.001) females. Also, the average outflow rate is significantly higher in 19-year-old young women than in the 18-year-olds (p <0.05).

The indicator of the maximum peak exhalation flow in 16-year-old young women is 6.581 ± 1.467 L/s, at 17 years old - 6.636 ± 1.072 L/s, at 18 years - 6.233 ± 1.688 L/s, at 19 years - 7.173 ± 1.661 L/s, at 20 years - 7.323 ± 1.918 L/s. The value of this spirographic index is significantly higher only in 20-year-old young women compared to 19-year-olds (p <0.05) females.

The rate of inhalation capacity in 16-year-old young women is 2.545 ± 0.437 L, at 17 years old - 2.727 ± 0.645 L, at 18 years old - 2.687 ± 0.549 L, at 19 years - 2.552 ± 0.403 L, at 20 years old - 2.627 ± 0.387 L. The true differences of this spirographic index within the juvenile period of ontogenesis in young women have not been established.

The rate of residual expiratory volume in 16-year-old young women is 1.267 ± 0.497 L, at 17 years old - 1.251 ± 0.291 L, at 18 years old - 1.325 ± 0.286 L, at 19 years - 1.578 ± 0.427 L, in the 20 years old - 1.676 ± 0.563 L. The size of this spirographic index is significantly higher in 20-year-old young women than in 16-year-olds (p <0.01), 17-year-olds (p <0.01), and 18-year-olds (p <0.01) females. Also, the residual expiratory rate is significantly higher in 19-year-old young women than in 17-year-olds (p <0.01) and 18-year-olds (p <0.05).

The rate of forced inhalation flow, which is 50% of exhalation from the forced vital capacity in 16-year-old young women, is 2.284 ± 0.573 L/s, at 17 years of age - 2.265 ± 0.856 L/s, at 18 years of age - 2.374 ± 1.000 L/s, at 19 years - 2.412 ± 0.812 L/s, at 20 years - 2.557 ± 0.869 L/s. The value of this spirographic index is significantly higher only in 19-year-old young women compared with 16-year-olds (p <0.05) females.

The rate of one-second volume of forced exhalation in 16-year-old young women is 3.159 ± 0.556 L, at 17 years old - 3.214 ± 0.510 L, at 18 years old - 3.204 ± 0.604 L, at 19 years - 3.432 ± 0.688 L, at 20 years - 3.551 ± 0.682 L. The value of this spirographic index is statistically significantly higher in 20-year-old young women than in 16-year-olds (p <0.05), 17-year-olds (p <0.05), and 18-year-olds (p <0.05) females.

The Tiffeneau-Pinelli index for 16-year-old young women is 89.24 ± 7.90%, at the age of 17 - 86.85 ± 7.14%, at 18-year-olds - 86.81 ± 7.68%, at 19-year-olds - 87.82 ± 7.46%, at the age of 20 - 87.68 ± 10.87%. The true differences of this spirographic index within the juvenile period of ontogenesis in young women have not been established.

It was established that the lifetime capacity of lungs in 17-year-old young men is 5.344 ± 0.701 L, in 18 years - 5.477 ± 0.805 L, at 19 years - 5.561 ± 0.712 L, at 20 years - 5.809 ± 0.916 L, in 21-year-olds - 6.101 ± 0.789 L. The value of this spirographic index is significantly higher in 21-year-old young men than in the 17-year-olds (p <0.001), 18-year-olds (p <0.01) and 19-year-old (p <0.05) year-olds than in the 17-year-olds (p <0.05) young men.

The indicator of forced vital capacity in 17-year-old young men is 5.116 ± 0.994 L, at 18-year-olds - 5.307 ± 1.130 L, in 19-year-olds - 5.200 ± 0.865 L, at 20-year-olds - 5.402 ± 1.119 L, at 21 years old - 6.047 ± 0.821 L. The value of this spirographic index is significantly higher in 21-year-old compared to 17-year-olds (p <0.001), 18-year-olds (p <0.01), 19-year-olds (p <0.001) and 20-year-olds (p <0.05) male.

Indicator of forced capacity of the lungs on the inspiration in 17-year-old young men is 3.608 ± 1.147 L, at 18 years old - 3.702 ± 1.124 L, at 19 years old - 3.704 ± 1.024 L, at 20 years old - 3.677 ± 1.134 L, in the 21-year-old - 3.714 ± 0.930 L. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The rate of maximum random ventilation in 17-year-old young men is 153.3 ± 38.7 L/min, 18 years old - 181.5 ± 34.1 L/min, at 19 years - 176.5 ± 32.3 L/min, at 20 years - 189.9 ± 34.0 L/min, at 21 years - 200.0 ± 33.2 L/min. The value of this spirographic index is significantly higher in 21-year-old young men than in the 17-year-olds (p <0.001), 18-year-olds (p <0.05) and 19-year-olds (p <0.05) (p <0.001), at 19 years of age than in the 17-year-olds (p <0.05) and in 18-year-olds than in the 17-year-olds (p <0.01) young men.

The indicator of volumetric exhalation velocity, corresponding to 25% of the forced vital capacity in 17-year-old young men, is 7.985 ± 1.789 L/s, at 18 years old - 8.780 ± 2.012 L/s, at 19 years - 8.007 ± 2.417 L/s, at 20 years old - 8.647 ± 2.139 L/s, at 21 years old - 9.261 ± 1.832 L/s. The value of this spirographic index is statistically significantly higher only in 21-year-old young men compared with 17-year-olds (p <0.01) males.

The indicator of the volume exhaust velocity, correspondingly, in 50% of the forced vital capacity in 17-year-old young men is 5.654 ± 1.270 L/s, at 18 years of age - 6.242 ± 1.706 L/s, at 19 years - 5.156 ± 1.822 L/s, at 20 years of age - 5.746 ± 1.885 L/s, at 21 years of age - 5.963 ± 1.490 L/s. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The indicator of volume exhaust velocity, corresponding

to 75% of the forced vital capacity in 17-year-old young men, is 2.963 ± 1.038 L/s, at 18 years old - 2.985 ± 1.031 L/s, at 19 years - 2.609 ± 1.120 L/s, at 20 years old - 2.954 ± 1.250 L/s, at 21 years old - 2.948 ± 0.990 L/s. The value of this spirographic index is statistically significantly higher only in 18-year-old young men compared with 19-year-olds ($p < 0.05$) males.

The indicator of the volume exhaust velocity from 75% to 85% of exhalation from the forced vital capacity in 17-year-old young men is 2.342 ± 0.902 L/s, at 18 years of age - 2.245 ± 0.871 L/s, at 19 years of age - 1.968 ± 0.927 L/s, at 20 years - 2.245 ± 1.093 L/s, at 21 years of age - 2.267 ± 0.948 L/s. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The average expiratory flow rate for 17-year-old young men is 5.028 ± 1.235 L/s, at 18 years old - 5.486 ± 1.394 L/s, at 19 years - 4.692 ± 1.663 L/s, at 20 years - 5.133 ± 1.618 L/s, at 21 years of age - 5.254 ± 1.346 L/s. Statistically significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The indicator of the maximum peak exhalation flow in 17-year-old young men is 9.676 ± 2.403 L/s, at the age of 18 years - 10.49 ± 2.29 L/s, at 19 years - 10.47 ± 2.09 L/s, at 20 years - 10.99 ± 2.26 L/s, at 21 years of age - 11.33 ± 2.27 L/s. The value of this spirographic index is significantly higher in 21-year-old young men than in the 17-year-olds ($p < 0.01$) and in 20-year-old young men compared with 17-year-olds ($p < 0.05$) males.

The rate of inhalation capacity in 17-year-old young men is 3.456 ± 0.644 L, at 18 years old - 3.490 ± 0.558 L, at 19 years old - 3.468 ± 0.477 L, at 20 years old - 3.711 ± 0.760 L, at 21 years old - 3.806 ± 0.751 L. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The indicator of residual expiratory volume in 17-year-old young men is 1.926 ± 0.484 L, at 18 years old - 1.983 ± 0.680 L, at 19 years - 2.094 ± 0.680 L, at 20 years old - 2.098 ± 0.649 L, in the 21-year-old - 2.293 ± 0.548 L. The value of this spirographic index is statistically significantly higher in 21-year-old young men compared with 17-year-olds ($p < 0.01$) males.

The rate of forced flow of inspiration, which is 50% of exhalation from the forced vital capacity in 17-year-old young women, is 2.911 ± 1.466 L/s, at 18 years old - 2.935 ± 1.105 L/s, at 19 years - 2.871 ± 1.072 L/s, at 20 years - 2.991 ± 1.403 L/s, at 21 years - 3.182 ± 1.183 L/s. Statistically significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

The rate of one-second volume of forced exhalation in 17-year-old young women is 4.428 ± 0.844 L, at 18 years - 4.598 ± 0.975 L, at 19 years - 4.344 ± 0.841 L, at 20 years - 4.720 ± 0.885 L, at 21-year-olds - 5.076 ± 0.722 L. The value of this spirographic index is significantly higher in 21-year-old young men compared with 17-year-olds ($p < 0.01$), 18-year-olds ($p < 0.05$) and 19-year-olds ($p < 0.01$) males.

The Tiffeneau-Pinelli index of 17-year-old young men is 86.47 ± 6.32%, at 18-year-olds - 86.39 ± 5.20%, at 19-year-olds - 83.53 ± 8.39%, at age 20 - 85.22 ± 5.32%, at age 21 - 84.10 ± 6.93%. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

Discussion

The juvenile period of ontogenesis is marked by an uneven progressive increase in a number of morpho-functional indicators of the body [16]. Parameters of the respiratory system are not an exception to this regularity. The identified racial and population differences in the parameters of external respiration make relevant searches for normative indicators for the inhabitants of certain regions. But, unfortunately, data on the characteristics of external respiration indices in practically healthy persons within the youth period of ontogenesis does not exist at the representatives of the Podillia ethno-territorial region. Namely representatives of a separate population with a certain amplitude of acclimatization opportunities and inherited adaptation opportunities should take a prominent position in medical biology forecasting. To assess the health of an individual, it is necessary to have an idea of those indicators that can be considered normal for it as a representative of a specific ethno-social population, which is adapted to a certain complex of exogenous factors. This is especially relevant for the Ukrainian population, as the result of the demographic crisis of the twentieth century, environmental degradation, which is characteristic of many regions of the country, has created conditions that can affect the basic characteristics of the human population [2]. The results of scientific research by Tymchenko O. I. and others [22] suggest that the population of Ukraine is not adapted to the conditions of existence. Therefore, it once again emphasizes the urgent need to study the peculiarities of the morpho-functional parameters of the body, in particular the parameters of external respiration, in practically healthy persons of the Ukrainian ethnic group living on a separate territory of Ukraine - Podillia.

As a result of our study, it was found that most spirometric indicators in young women and young men have positive growth dynamics within the juvenile period of ontogenesis. Thus, the vital capacity of lungs in 16-year-old young women has the smallest value, at 20-year-olds - the largest. In young men of 17 years, the lifetime capacity of lungs is significantly lower than in young men of the 20 and 21 years. Thus, the progressive age-related increase of this indicator occurs in the second half of the youth period of ontogenesis: in the female population of 19-20 years, in young men from 20-21 years.

The rate of forced vital capacity is the volume of air that can escape from the lungs with forced exhalation after a maximum inhalation and in the normal range of 70-80% of

the lung capacity. We found that the progressive age-related increase in this indicator in young women was observed in the last 2 years of the youthful period of ontogenesis (from 19-20 years). In young men, an increase in forced vital capacity is observed at the end of the youthful period of ontogenesis, only from the age of 21.

The results obtained by us do not contradict the conclusions made by Alfrayh A. et al. [1] that the indicators of forced vital capacity increase with age in juvenile men and women.

We found that in young women the indicator of forced capacity of the lungs on the inspiration in the 16 and 17-year-old practically does not differ, in 18-year-old young women it is slightly larger, and in 19 years the greatest value of this indicator is observed. In males within the juvenile period, there are no significant differences in the ontogenesis in the size of this spirographic index.

In young men, there was a significant progressive increase in the rate of maximum random ventilation throughout the juvenile period of ontogeny, and in young women, this indicator is significantly increased only at the end of the juvenile period of ontogenesis (from 20 years).

The indicator of volume expiratory rate, correspondingly, in 25% of the forced vital capacity, has a progressive age increase in female subjects in the second half of the youth period of ontogenesis (from 19-20 years), and in males only at the end of this period of ontogenesis (at 21 year).

It is established that the indicator of volume exhalation velocity, correspondingly, in 50% of the forced vital capacity, has significantly higher values for young women at the end of the juvenile period of ontogenesis (from 19-20 years). Significant differences in young men of this spirographic index within the juvenile period of ontogenesis have not been established.

In young women, at the beginning of the youthful period of ontogeny, the progressive age dynamics of the volume expiratory rate indicator, respectively, in 75% of the forced vital capacity, is not observed, only in 20 years we observed a rapid increase of this indicator. It is established that this spirometric index has no progressive age dynamics in young men, it is significantly lower among young men in the middle of the youthful period of ontogenesis (19 years of age compared with 18-year-old young men).

It was established that the indicator of volume exhalation velocity from 75% to 85% of exhalation from forced vital capacity in the female population only in the last year of the youth period of ontogenesis has a rapid progressive age increase, in persons 16 - 19 years the value of this indicator did not differ significantly. Significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

Thus, the positive age dynamics of the volume velocity of exhalation on different segments of the bronchopulmonary segment is established, indicating the absence of peripheral obstruction in bronchi of different diameters. Research results of scientists [17] also indicate that the determination of the average expiration flow (FEF 25-75%) is a useful tool for clinical and epidemiological studies of pediatric bronchial asthma.

We have found that the average expiratory flow rate of young women in the last 2 years of the youth period is significantly higher than that of the female sex of younger age groups. Statistically significant differences of this spirographic index within the juvenile period of ontogeny in young men have not been established.

It was found that the maximum peak exhalation rate only in 20-year-old young women is significantly higher compared to 19-year-old female subjects. Progressive age increase of the index of maximum peak exhalation in young men is observed in the second half of the youthful period of ontogenesis (20-21 years).

Significant differences in the rate of inspiration within the juvenile period of ontogenesis in young men and young women have not been established.

The progressive age increasing in young women of the residual exhalation volume at the end of the youthful period of ontogenesis (in 19 and 20 years) was determined. In young men, this indicator is rapidly increasing at 21, and in previous years of this age interval only a gradual increase in the residual volume of exhalation is noted.

We have established a moderate increase with the age of the value of the indicator of forced inspiratory flow, which is 50% of the exhalation from the forced vital capacity, but the reliable difference is detected only when comparing its value in 19-year-old young women with 16-year-old. Statistically significant differences of this spirographic index within the juvenile period of ontogeny in young men are not defined.

It was established that the rate of one-second volume of forced exhalation in young women moderately increases in the period from 16 to 20 years, but only in the last year of the youthful period of ontogenesis, the value of this indicator was significantly more significant compared with the 16-year-olds, 17-year-olds and 18-years-old females. Progressive age-related increase in one-second volume of forced exhalation in young men is observed at the end of the youthful period of ontogenesis (21 years). Studying features of a one-second volume of forced exhalation Alfrayh A. et al. [1] found that this indicator increases from 6 to 18 years in males and females.

True differences in the Tiffeneau-Pinelli index within the juvenile period of ontogenesis in young women and young men are not established.

The age dynamics of spirometric indices scientists [5] explain by an increase in the strength of the respiratory muscles, in particular the forces of the intercostal muscles, as well as the increase in the elasticity of the lungs. These changes contribute to the improvement of functional parameters that are determined during spirometry. It has been proved that there is a direct relationship between the amount of forced exhalation volume for 1 second (FEV1), forced vital capacity of the lungs (FVC) and the mean expiratory flow (FEF 25-75%) with age, length and body weight [10]. In

addition, a higher body mass index had a positive effect on the value of forced exhalation volume for 1 second (FEV1) and forced vital capacity (FVC) in the direction of their increase [15, 18, 20]. Thus, anthropometric indices are strong determinants of lung function change.

Conclusions

1. In young women the progressive age dynamics of the following spirometric indicators is set: vital capacity, forced vital capacity, forced capacity of the lungs on the inspiration, volume of exhalation velocity, respectively, in 25% and 50% of the forced vital capacity, the average flow of exhalation, residual volume of exhalation and forced inflow, which is 50% of exhalation from the forced vital capacity. In the last year of the youthful period of ontogenesis in female subjects, the maximum arbitrary ventilation of lungs is increased, the expiratory volume is 75%, and from 75% to 85% of exhalation from the forced vital capacity, the one-second volume of forced exhalation and maximum peak flow exhale

2. In young men found that the vital capacity, the maximum arbitrary ventilation of the lungs and the maximum peak flow of exhalation increased within the juvenile period of ontogenesis. And increase in forced vital capacity, volumetric exhalation velocity, respectively, in 25% of the forced vital capacity, residual exhalation volume, one-second volume of forced exhalation was observed at the end of the youthful period of ontogenesis, only from 21 years.

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ВІКОВІ ОСОБЛИВОСТІ СПІРОМЕТРИЧНИХ ПОКАЗНИКІВ В МЕЖАХ ЮНАЦЬКОГО ПЕРІОДУ ОНТОГЕНЕЗУ

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У сучасному світі є багато причин (зменшення еластичності легень, зниження бронхіальної прохідності, зменшення сили дихальних м'язів), що впливають на показники зовнішнього дихання. Знання вікових, статевих та регіональних особливостей спірометричних показників допомагає розмежувати та виявити ступінь порушення біомеханіки дихання і вибрати ефективні засоби лікування, що найбільш відповідають встановленим порушенням. Мета роботи - встановити вікові особливості показників спірографії у практично здорових юнаків і дівчат у межах юнацького періоду онтогенезу. Нами було проведено обстеження 141 дівчини (з 16-ти до 20 років) та 154 юнаків (з 17-ти до 21 року). Спірографічне дослідження проводили за загальноприйнятою методикою Американської асоціації пульмонологів прийнятої у 1994 році на апараті Medgraphics Pulmonary Function System 1070 series. Аналіз отриманих результатів проведений за допомогою ліцензійної програми "Statistica 5.5" з використанням непараметричних методів оцінки показників. У дівчат виявлено прогресивну вікову динаміку життєвої ємності легень, форсованої життєвої ємності, форсованої ємності легень на вдиху, об'ємної швидкості видиху відповідно у 25% та 50% від форсованої життєвої ємності, середнього потоку видиху, залишкового об'єму видиху та форсованого потоку вдиху, що становить 50% видиху від форсованої життєвої ємності. У останній рік (20 років) юнацького періоду онтогенезу у дівчат збільшуються максимальна довільна вентиляція легень, показник об'ємної швидкості видиху відповідно у 75% та у від 75% до 85% видиху від форсованої життєвої ємності, односекундного об'єму форсованого видиху та максимального пікового потоку видиху. У межах юнацького періоду онтогенезу в юнаків збільшуються життєва ємність легень, максимальна довільна вентиляція легень і максимальний піковий потік видиху. Лише у останній рік юнацького періоду онтогенезу (21 рік) в юнаків спостерігається збільшення форсованої життєвої ємності, об'ємної швидкості видиху відповідно у 25% від форсованої життєвої ємності, залишкового об'єму видиху, односекундного об'єму форсованого видиху.

Ключові слова: *спірометрія, спірометричні показники, юнаки, дівчата.*

ВОЗРАСТНЫЕ ОСОБЕННОСТИ СПИРОМЕТРИЧЕСКИХ ПОКАЗАТЕЛЕЙ В ПРЕДЕЛАХ ЮНОШЕСКОГО ПЕРИОДА ОНТОГЕНЕЗА

Кириченко Ю. В.

В современном мире есть много причин (уменьшение эластичности легких, снижение бронхиальной проходимости, уменьшение силы дыхательных мышц), влияющих на показатели внешнего дыхания. Знание возрастных, половых и региональных особенностей спирометрических показателей помогает разграничить и выявить степень нарушения биомеханики дыхания и выбрать эффективные средства лечения, наиболее отвечающих установленным нарушением. Цель работы - установить возрастные особенности показателей спирографии у практически здоровых юношей и девушек в пределах юношеского периода онтогенеза. Нами было проведено обследование 141 девушек (с 16 до 20 лет) и 154 юношей (с 17-ти и до 21 года). Спирографическое исследования проводили по общепринятой методике Американской ассоциации пульмонологов принятой в 1994 году на аппарате Medgraphics Pulmonary Function System 1070 series. Анализ полученных результатов проведен с помощью лицензионной программы "Statistica 5.5" с использованием непараметрических методов оценки показателей. У девушек выявлено прогрессивную возрастную динамику жизненной емкости легких, форсированной жизненной емкости, форсированной емкости легких на вдохе, объемной скорости выдоха соответственно в 25% и 50% от форсированной жизненной емкости, среднего потока выдоха, остаточного объема выдоха и форсированного потока вдоха, что составляет 50% выдоха от форсированной жизненной емкости. В последний год (20 лет) юношеского периода онтогенеза у девушек увеличиваются максимальная произвольная вентиляция легких, показатель объемной скорости выдоха соответственно у 75% и у от 75% до 85% выдоха от форсированной жизненной емкости, односекундного объема форсированного выдоха и максимального пикового потока выдоха. В рамках юношеского периода онтогенеза у юношей увеличиваются жизненная емкость легких, максимальная произвольная вентиляция легких и максимальный пиковый поток выдоха. Лишь в последний год юношеского периода онтогенеза (21 год) у юношей наблюдается увеличение форсированной жизненной емкости, объемной скорости выдоха соответственно у 25% форсированной жизненной емкости, остаточного объема выдоха, односекундного объема форсированного выдоха.

Ключевые слова: *спирометрия, спирометрические показатели, юноши, девушки.*