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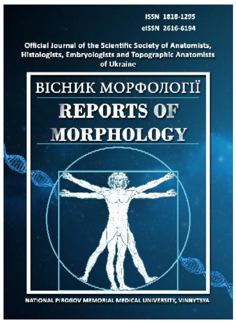

Peculiarities of correlations between spirometric and anthropometric indicators in practically healthy young women of mesomorphic somatotype

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The issue of studying the relationships between indicators of the external structure of the body and spirographic parameters in persons of a certain sex, age, ethno-territorial zoning remains relevant, especially from the point of view of the need to determine the reference values of indicators of external breathing. The purpose of the study was to determine the peculiarities of the relationship between spirographic parameters and indicators of the external structure of the body in practically healthy young women of the mesomorphic constitutional type of the Podilia region of Ukraine. We conducted a complex clinical and laboratory study of young women aged 16 to 20 years, which corresponds to the youthful period of ontogenesis. 109 practically healthy young women were selected, in whom no deviations in the state of health were detected according to the results of radiography, echocardiography, tetrapolar rheovasography and rheoencephalography, sonographic examination of parenchymal organs of the abdominal cavity and thyroid gland, general and biochemical blood analysis. For this group of subjects, we performed a spirographic examination using the Medgraphics Pulmonary Function System 1070 series according to the methodology of the American Pulmonology Association and the European Respiratory Society (2019). The anthropometric study was carried out according to the method of V. V. Bunak (1941), the somatotypological study - according to the calculated modification of the Heath-Carter method (1990). The assessment of the component composition of body weight was carried out according to Matiegka method (1921). After somatotyping, it was found that 32 young women had a mesomorphic type of constitution, for which Spearman's correlation analysis was conducted in the licensed software package "Statistica 5.5". It was established that the majority of spirographic indicators in practically healthy young women of the mesomorphic somatotype had isolated statistically significant correlations with anthropo-somatotypological parameters, with the exception of parameters that reflect lung capacities. Vital capacity at rest, had the largest number and strength of correlations, was significantly associated with the value of 24 anthropo-somatotypological indicators. Total, longitudinal and girth body dimensions, the ectomorphic component of the somatotype, muscle, bone and fat mass of the body were most often correlated with the capacity indicators of external respiration. All speed spirographic indicators and maximum peak expiratory flow were correlated with the skinfold thickness. The study of correlations is the basis of further mathematical modeling to determine the appropriate spirographic indicators in an individual representative of the female sex of the juvenile age of the mesomorphic somatotype.

Keywords: *spirometry, anthropometry, mesomorphic somatotype, correlation, young women, youth.*

Introduction

The modern human body is characterized by a large spectrum of phenotypic variability of anatomical and physiological features. The use of correlation analysis, as one of the main methods of assessing the harmony of physical development, allows you to comprehensively consider the interrelationships of parameters that reflect the functions and structure of our body. Over the past decades, convincing experience has been accumulated in identifying relationships between individual morphofunctional indicators and somatometric parameters that characterize the external structure of the body [10, 19, 21, 22]. The issue of studying the relationship between indicators of the external structure of the body and spirographic parameters in persons of a certain sex, age, ethno-territorial zoning remains relevant, especially from the point of view of the need to determine the reference values of indicators of external respiration [5, 8, 15] and an individual approach to their determination [1, 14]. Which, in turn, is due to the significant progression and prevalence of respiratory diseases among the population of different countries [7, 17, 18, 25]. In particular, in Ukraine, it is the most widespread pathology, which creates a global problem for the health care of the country due to a large percentage of the impression of the working population, comorbidity of the pathologies of the lungs themselves and the negative impact on concomitant diseases [4, 13].

Currently, in scientific research, there is information about the connection of certain indicators of the external structure of the body (most often - height while standing and sitting, body weight) with spirometric indicators [9]. An inverse relationship between the characteristics of fat deposition (the amount of fat and fat-free mass, the total amount of water in the human body, the anterior-posterior size of the abdomen) and the indicators of pulmonary ventilation was found [5, 8, 15, 24]. Unfortunately, there is little data on correlations of rapid spirographic indicators, lung volumes and capacities with total and different groups of partial body sizes in practically healthy individuals of a certain sex, age, and region of Ukraine. Therefore, the solution of this scientific question is relevant and has undeniable practical significance.

The purpose of the study was to determine the peculiarities of the relationship between spirographic parameters and indicators of the external structure of the body in practically healthy young women of the mesomorphic constitutional type in the Podilia region of Ukraine.

Materials and methods

On the basis of the research center of the National Pirogov Memorial Medical University, Vinnytsia, we conducted a comprehensive clinical and laboratory study of women aged 16 to 20 years, which corresponds to the youthful period of ontogenesis. 109 practically young women (YW) were selected, in which no deviations in health were detected according to the results of radiography, echocardiography, tetrapolar rheovasography and rheoencephalography, sonographic examination of parenchymal organs of the abdominal cavity and thyroid gland, general and biochemical blood analysis. All subjects (according to the results of the questionnaire) were residents of the Podilia region of Ukraine. We performed a spirographic examination of this group of subjects using the Medgraphics Pulmonary Function System 1070 series according to the American Pulmonology Association and the European Respiratory Society method [6]. Lung volumes and capacities and speed spirographic indicators were evaluated [11].

The anthropometric study was carried out according to the method of V. V. Bunak [2], during which 49 parameters of the external structure of the body were determined. The somatotypological study was carried out according to the calculated modification of the Heath-Carter method [3]. The assessment of the component composition of body weight was carried out according to the Matiegka method [12]. After somatotyping, it was found that 32 YW had a mesomorphic type of constitution, and Spearman's correlation analysis was performed for them in the licensed software package "Statistica 5.5".

The research was carried out within the framework of the university-wide topic "Somato-viscerometric features of the human body in different periods of ontogenesis" (state registration № 0121U113772) and was approved at a meeting of the bioethics commission (Protocol № 4 dated May 18, 2023).

Results

Analyzing the interrelationships of spirographic parameters reflecting lung capacities in practically healthy YW mesomorphic somatotype with total and partial body dimensions, it is necessary to note a large number of revealed reliable correlations and unreliable connections of medium strength. Thus, *the forced vital capacity of the lungs* had significant only direct connections with constitutional characteristics, in particular with all total and almost all longitudinal dimensions of the body, girths of the stressed shoulder, waist, hips and feet, acromial diameter and external conjugate, skinfold thickness on the forearm (Table 1). The value of the *forced capacity of the lungs on inspiration* also had direct correlations of medium strength with all total and longitudinal dimensions of the body, the width of the distal epiphysis of the shoulder, the girth dimensions of the segments of the upper and lower limbs, chest, waist and hips, the external conjugate, the size of the muscle and bone mass of the body. *Vital capacity*, determined at rest, had the largest number and strength of reliable connections with indicators of the external structure of the body (see Table 1). A direct strong relationship was found with the height of the pubic point and this spirometric indicator. In addition, vital capacity was correlated with all total and longitudinal dimensions of the body, the width of the distal epiphysis of the shoulder, girth dimensions of the stressed arm, hip, lower leg in the upper third, neck, waist, hand, foot, chest, acromial diameter, ectomorphic component of the somatotype, and all components body weight composition. *Inspiratory capacity* in practically healthy YW mesomorphic somatotypes had correlations of medium strength with all total body dimensions and height of all anthropometric points, the width of the distal

Table 1. Values of correlation coefficients (r) of anthropometric dimensions with volumes spirographic indicators in mesomorph YW.

Anthropometric indicators	Lung capacity				Lung volumes	
	FVC	FIVC	SVC	IC	FEV1	ERV
body weight	**0.45**	**0.48**	**0.59**	**0.48**	**0.32**	**0.37**
body length	**0.47**	**0.50**	**0.52**	**0.39**	**0.33**	**0.30**
body surface area	**0.47**	**0.51**	**0.58**	**0.44**	**0.33**	**0.35**
height of suprasternal point	**0.42**	**0.51**	**0.57**	**0.49**	0.28	**0.32**
pubic point height	**0.45**	**0.59**	**0.62**	**0.44**	0.27	**0.42**
acromial point height	**0.39**	**0.53**	**0.55**	**0.44**	0.23	**0.31**
finger point height	0.29	**0.41**	**0.44**	**0.30**	0.06	**0.32**
height trochanter point	**0.33**	**0.43**	**0.54**	**0.40**	0.18	**0.36**
the width of the shoulder epiphysis	0.22	**0.38**	**0.32**	0.08	0.13	**0.34**
width of the epiphysis of the forearm	0.13	0.18	0.24	0.19	0.06	0.17
width of femoral epiphysis	-0.27	-0.01	-0.16	-0.04	-0.24	-0.10
the width of crus epiphysis	0.07	-0.25	0.16	**0.30**	0.15	0.01
the girth of the tense shoulder	**0.30**	0.24	**0.30**	0.27	0.25	0.06
the girth of the relaxed shoulder	0.29	0.16	0.27	**0.36**	0.25	-0.06
forearm girth in the upper part	0.02	**0.34**	0.19	0.19	0.06	0.05
forearm girth in the lower part	0.02	**-0.31**	0.01	0.29	0.09	-0.24
thigh girth	0.09	**0.40**	**0.36**	0.25	-0.03	0.22
crus girth in the upper part	0.19	**0.32**	**0.47**	**0.38**	-0.02	**0.33**
crus girth in the lower part	-0.02	-0.17	0.05	-0.01	-0.03	0.11
neck girth	0.23	0.27	**0.39**	0.28	0.17	0.19
waist girth	**0.30**	**0.55**	**0.44**	0.28	0.18	0.20
girth of the thighs	**0.38**	**0.44**	0.19	0.13	0.29	0.08
hand girth	0.14	-0.10	**0.32**	0.23	0.07	**0.32**
foot circumference	0.31	**0.46**	**0.32**	0.09	0.18	0.28
chest girth (inhale)	0.12	**0.41**	**0.51**	**0.37**	0.06	**0.32**
chest girth (exhalation)	0.07	**0.38**	**0.45**	**0.35**	0.04	0.26
chest girth (pause)	0.09	**0.37**	**0.50**	**0.45**	0.05	0.28
sagittal mid-thoracic diameter	0.12	0.11	0.26	**0.37**	0.09	-0.04
acromial diameter	**0.33**	0.25	**0.42**	0.29	0.28	0.28
interspinous distance	-0.01	0.15	-0.03	0.10	0.03	-0.10
intercristal distance	0.05	0.26	0.07	0.14	-0.02	-0.11
intertrochanteric distance	0.02	0.16	0.05	0.10	0.06	-0.01
external conjugate	**0.37**	**0.32**	0.01	-0.11	0.25	0.05
skinfold thickness on the forearm	**0.31**	0.16	0.13	0.01	0.28	0.08
skinfold thickness under the scapula	0.27	-0.02	-0.02	0.17	0.21	-0.29

Continuation of table 1.

Anthropometric indicators	Lung capacity				Lung volumes	
	FVC	FIVC	SVC	IC	FEV1	ERV
skinfold thickness on the stomach	-0.04	-0.18	0.21	0.20	-0.14	0.11
skinfold thickness on the side	-0.08	-0.05	0.26	0.19	-0.10	0.18
skinfold thickness on the thigh	0.05	0.06	0.25	0.27	-0.05	0.13
skinfold thickness on the crus	0.04	0.02	0.08	0.16	-0.03	-0.04
endomorphic component	0.01	-0.05	0.15	0.13	-0.05	0.03
mesomorphic component	-0.20	-0.18	-0.24	-0.20	-0.16	-0.21
ectomorphic component	0.14	0.11	**0.34**	**0.31**	0.11	**0.31**
muscle mass of the body	0.26	**0.45**	**0.46**	**0.37**	0.15	0.25
body bone mass	0.14	**0.30**	**0.37**	0.25	0.03	**0.32**
body fat mass	0.23	0.23	**0.40**	**0.35**	0.11	0.17

Notes: here and in the following, reliable correlations of average strength are highlighted in blue, unreliable correlations of average strength in pink, reliable strong correlations in green; FVC - forced vital capacity; FIVC - forced inspiratory vital capacity; SVC - slow vital capacity (at rest); IC - inspiratory capacity; FEV1 - forced expiratory volume in the first second; ERV - expiratory reserve volume.

epiphysis of the tibia, the girth of the relaxed shoulder and the upper third of the tibia, the chest, the sagittal midthoracic diameter, the ectomorphic component of the somatotype and muscular and body fat mass.

Spirometric indicators, which reflected lung volumes, had a small number of reliable correlations with anthropo-somatotypological indicators in YW mesomorphs. Thus, *forced expiratory volume in the first second* did not have any significant correlation, but with all total body dimensions, non-significant average strength direct relationships were established. *Expiratory residual volume* had only 4 significant correlations with constitutional characteristics, but it should be noted that direct mean ligament strength was recorded with all total and longitudinal body dimensions, width of the distal epiphysis of the shoulder, girths in the upper third of the leg, hand and chest on inhalation, the ectomorphic component of the somatotype and the bone mass of the body (see Table 1).

Speed spirographic indicators in practically healthy YW of mesomorphic somatotype had isolated statistically significant correlations with body structure parameters (Table 2). *The expiratory volume rate, respectively, at 25 % of the forced vital capacity of the lungs* (FVC) had only an unreliable direct mean correlation with the skinfold thickness under the scapula. *Volumetric velocity of exhalation at 50 % of FVC*, respectively, had inverse, non-reliable average strength relationships with hip girth, transverse lower thoracic diameter, and skinfold thickness on the abdomen. *Expiratory volume, respectively, at 75 % of FVC* also had only inverse correlations, reliable - with skinfold thickness on the side and abdomen, unreliable -

Table 2. Values of correlation coefficients (r) of anthropometric dimensions with speed spirographic indicators in mesomorph YW.

Anthropometric indicators	Speed spirographic indicators				
	FEF 25 %	FEF 50 %	FEF 75 %	FEF 25-75 %	FEF 75-85 %
body weight	-0.07	-0.03	0.06	0.05	0.2
body length	0.02	-0.05	-0.01	0.02	0.1
body surface area	0.01	-0.03	0.01	0.04	0.17
height of suprasternal point	-0.11	-0.03	0.07	0.03	0.27
pubic point height	-0.01	0.05	0.11	0.11	0.21
acromial point height	-0.10	-0.09	0.04	0.01	0.23
finger point height	-0.14	-0.18	-0.08	-0.14	0.10
height trochanter point	-0.04	-0.07	-0.05	-0.04	0.12
the width of the shoulder epiphysis	0.04	-0.10	-0.08	-0.09	-0.02
width of the epiphysis of the forearm	-0.04	-0.10	0.01	-0.06	-0.01
width of femoral epiphysis	-0.15	-0.19	-0.12	-0.21	0.02
the width of crus epiphysis	0.02	-0.11	0.08	0.06	0.22
the girth of the tense shoulder	0.03	0.02	0.04	0.08	0.10
the girth of the relaxed shoulder	-0.04	0.10	0.08	0.11	0.20
forearm girth in the upper part	-0.16	-0.14	-0.02	-0.10	0.12
forearm girth in the lower part	0.10	0.08	0.09	0.08	0.16
thigh girth	-0.18	**-0.30**	**-0.30**	-0.29	-0.13
crus girth in the upper part	-0.18	-0.21	-0.24	-0.25	-0.06
crus girth in the lower part	-0.05	0.05	0.27	0.19	0.16
neck girth	-0.06	-0.13	-0.04	-0.02	0.07
waist girth	-0.12	-0.21	-0.14	-0.14	0.06
girth of the thighs	0.09	0.10	0.20	0.12	0.28
hand girth	-0.14	-0.17	-0.03	-0.07	0.12
foot circumference	0.12	-0.02	-0.08	0.01	-0.07
chest girth (inhale)	-0.04	-0.27	-0.31	-0.19	-0.15
chest girth (exhalation)	-0.06	-0.28	-0.27	-0.19	-0.11
chest girth (pause)	-0.03	-0.24	-0.25	-0.15	-0.10
transverse mid-thoracic diameter	-0.19	-0.17	-0.03	-0.13	0.03
transverse lower-thoracic diameter	-0.14	**-0.31**	-0.29	**-0.32**	-0.14
sagittal mid-thoracic diameter	-0.14	-0.10	-0.03	-0.02	0.16
acromial diameter	-0.02	0.06	0.13	0.14	0.18
interspinous distance	0.19	0.07	0.15	0.10	0.15
intercristal distance	0.18	-0.05	-0.10	-0.07	-0.07
intertrochanteric distance	-0.01	-0.05	0.15	0.03	0.18
external conjugate	0.24	0.20	0.18	0.21	0.12
skinfold thickness on the back surface of the shoulder	0.14	-0.01	-0.01	0.03	-0.05
skinfold thickness on the front surface of the shoulder	0.15	0.07	0.18	0.15	0.19
skinfold thickness on the forearm	0.27	0.14	0.22	0.24	0.15
skinfold thickness under the scapula	**0.33**	0.19	0.15	0.20	0.03
skinfold thickness on the stomach	-0.09	**-0.33**	**-0.40**	**-0.33**	**-0.37**
skinfold thickness on the side	-0.03	-0.27	**-0.35**	-0.25	-0.29
skinfold thickness on the thigh	0.12	0.01	-0.24	-0.12	-0.22

Continuation of table 2.

Anthropometric indicators	Speed spirographic indicators				
	FEF 25 %	FEF 50 %	FEF 75 %	FEF 25-75 %	FEF 75-85 %
skinfold thickness on the crus	0.18	0.06	-0.15	-0.06	-0.20
endomorphic component	0.09	-0.19	-0.25	-0.17	-0.26
mesomorphic component	0.23	-0.12	-0.29	-0.19	**-0.35**
ectomorphic component	-0.11	0.09	0.18	0.10	**0.31**
muscle mass of the body	-0.24	-0.18	-0.01	-0.08	0.22
body bone mass	-0.14	-0.21	-0.10	-0.16	0.05
body fat mass	0.08	-0.11	-0.14	-0.08	-0.09

Notes: FEF 25% - forced expiratory flow in 25 % of FVC; FEF 50 % - forced expiratory flow respectively in 50 % of FVC; FEF 75% - forced expiratory flow respectively in 75 % of FVC; FEF 25-75% - forced mid-expiratory flow; FEF 75-85% - forced expiratory flow respectively from 75 % to 85 % exhalation from FVC.

Table 3. Values of correlation coefficients (r) of anthropometric dimensions with spirographic indicators in mesomorph YW.

Anthropometric indicators	Spirographic indicators				
	MVV	FEF max	FIF 50 %	FEV1 FVC	FEF50 FIF
body weight	-0.17	0.01	0.11	-0.14	-0.15
body length	-0.09	0.04	0.29	-0.24	-0.27
body surface area	-0.11	0.05	0.24	-0.23	-0.22
height of suprasternal point	-0.22	-0.03	0.12	-0.11	-0.15
pubic point height	-0.18	0.03	-0.08	-0.19	-0.03
acromial point height	-0.23	0.01	-0.03	-0.15	-0.10
finger point height	**-0.30**	-0.18	-0.04	-0.25	-0.24
height trochanter point	-0.07	0.08	0.02	-0.12	-0.12
the width of the shoulder epiphysis	-0.07	0.12	0.15	-0.19	-0.17
width of the epiphysis of the forearm	0.01	-0.04	-0.05	-0.16	-0.02
width of femoral epiphysis	**-0.36**	-0.12	0.05	0.08	-0.11
the width of crus epiphysis	0.09	0.12	**-0.38**	0.20	0.25
the girth of the tense shoulder	0.17	0.14	**0.40**	-0.14	-0.17
the girth of the relaxed shoulder	0.12	-0.01	0.27	0.04	-0.08
forearm girth in the upper part	0.06	-0.16	0.26	0.05	-0.18
forearm girth in the lower part	0.26	0.03	-0.14	0.20	0.25
thigh girth	-0.13	-0.17	0.18	**-0.37**	-0.11
crus girth in the upper part	-0.23	-0.13	-0.03	**-0.33**	-0.05
crus girth in the lower part	0.15	-0.11	-0.23	0.07	-0.03
neck girth	0.15	0.08	0.23	-0.21	-0.18
waist girth	-0.14	-0.02	0.17	-0.22	-0.20
girth of the thighs	-0.06	-0.01	0.29	-0.02	-0.31
hand girth	0.12	-0.20	0.13	-0.20	-0.16
foot circumference	-0.05	0.29	0.13	**-0.32**	-0.18
chest girth (inhale)	0.10	0.08	0.05	-0.26	-0.01
chest girth (exhalation)	0.07	0.06	0.06	-0.19	-0.03
chest girth (pause)	0.04	0.06	0.05	-0.18	-0.03
transverse mid-thoracic diameter	-0.09	-0.16	0.06	-0.25	-0.22
transverse lower-thoracic diameter	-0.12	-0.14	-0.19	-0.29	0.10
sagittal mid-thoracic diameter	0.11	-0.06	-0.15	0.05	0.14

Continuation of table 3.

Anthropometric indicators	Spirographic indicators				
	MVV	FEF max	FIF 50 %	FEV1 FVC	FEF50 FIF
acromial diameter	**0.30**	0.06	0.25	-0.08	-0.03
interspinous distance	0.07	0.21	0.21	0.21	-0.11
intercristal distance	-0.03	0.22	-0.16	-0.13	0.09
intertrochanteric distance	-0.07	-0.14	0.09	0.15	-0.11
external conjugate	-0.18	0.28	0.35	-0.02	**-0.40**
skinfold thickness on the back surface of the shoulder	0.17	0.20	-0.03	-0.17	-0.12
skinfold thickness on the front surface of the shoulder	0.19	0.13	0.23	-0.03	-0.20
skinfold thickness on the forearm	0.17	**0.31**	**0.30**	-0.07	-0.19
skinfold thickness under the scapula	0.09	**0.44**	-0.01	-0.10	0.18
skinfold thickness on the stomach	-0.03	0.09	0.05	**-0.38**	-0.06
skinfold thickness on the side	0.10	0.14	0.10	-0.28	0.03
skinfold thickness on the thigh	0.03	0.21	0.14	-0.21	0.10
skinfold thickness on the crus	0.09	0.20	0.08	-0.22	0.05
endomorphic component	0.07	**0.34**	-0.04	-0.28	0.19
mesomorphic component	0.22	**0.32**	0.25	-0.20	-0.08
ectomorphic component	-0.11	-0.04	**-0.33**	0.12	0.28
muscle mass of the body	-0.18	-0.21	0.09	-0.14	-0.17
body bone mass	-0.26	-0.06	-0.02	-0.13	-0.15
body fat mass	0.01	0.18	0.16	-0.28	-0.06

Notes: MVV - maximum voluntary ventilation; FEF max - maximum forced expiratory flow; FIF 50% - forced inspiratory flow at 50 % of FVC; FEV1/FVC - Tiffeneau-Pinelli index; FEF50/FIF - the ratio of the forced air flow in the middle of exhalation to the middle of inhalation.

with thigh girth. *The average expiratory flow*, which characterizes the expiratory volumetric rate, respectively, in 25-75 % of FVC, had only two unreliable inverse average relationships: with skinfold thickness on the abdomen and transverse lower thoracic diameter. The *value of expiratory volume velocity, respectively, from 75 % to 85 % of exhalation from FVC* in YW of the mesomorphic somatotype had reliable inverse correlations of average strength with skinfold thickness on the abdomen and the mesomorphic component of the somatotype, while a direct and unreliable relationship of average strength was found with the ectomorphic component.

We established that the *maximum voluntary ventilation* of the lungs in YW mesomorphic somatotype had only one reliable inversely proportional correlation with the width of the distal epiphysis of the thigh, and an unreliable feedback of medium strength was with the height of the finger anthropometric point, a direct one with the acromial diameter (Table 3). *The maximum peak exhalation flow* had direct connections of medium strength with indicators of subcutaneous fat deposition on the forearm and under the shoulder blade, as well as with the value of the endomorphic and mesomorphic components of the somatotype. An inverse reliable relationship was recorded *between the volumetric inspiratory rate, which is 50 % of FVC*, and the width of the distal epiphysis of the lower leg, and direct relationships with the girth of the stressed shoulder and skinfold thickness on the forearm. *The Tiffeneau-Pinelli index* was inversely proportional to the average strength of correlation with the size of girths (thighs, lower third of the legs, feet) and skinfold thickness on the abdomen. *The indicator of the ratio of the forced air flow in the middle of exhalation to the middle of inhalation* in YW of the mesomorphic somatotype had only one inverse, reliable correlation - with the value of the external conjugate (see Table 3).

Discussion

Scientific studies convincingly show that individuals of different sexes have different strength and direction of correlations between visceral and anthropo-somatotypological indicators of the body [16]. In addition, the number of modern epidemiological studies on sex differences in the prevalence and course of respiratory diseases is increasing [25], in particular, mortality in chronic obstructive pulmonary disease is now higher in women than in men [17]. Women have a greater tendency to develop chronic bronchitis [23]. Therefore, the study of the features of spirometric indicators, their interrelationships with the features of the body structure in women of a certain age and a separate constitutional type will be a reasonable basis for determining their proper values.

Based on the results of the analysis of the peculiarities of the relationships between spirographic indicators and parameters of the external structure of the body in practically healthy teenage girls of the mesomorphic constitutional type of the Podilia region of Ukraine, it was found that the largest number and strength of significant correlations had spirographic parameters reflecting lung capacities. In particular, vital capacity at rest had the largest number and strength of correlations, was significantly associated with the value of 24 anthropo-somatotypological indicators (48.98 % of all other body dimensions that were determined in this study), all correlations were direct, of medium strength, except for a strong correlation with the height of the pubic point. The forced vital capacity of the lungs was significantly associated with the value of 14 (28.57 %) indicators of the external structure of the body; it is the only capacitive spirographic parameter that did not correlate with any component of somatotype or body weight. Forced inspiratory lung capacity was correlated with 44.89 % of the anthropo-somatotypological body dimensions determined in this study, in particular with all total and longitudinal dimensions, as well as with the vast majority of body girth dimensions, muscle and bone mass of the body. The inspiratory capacity was significantly related to the value of 18 (36.73 %) indicators of the external structure of the body.

It is noteworthy that all lung capacities had correlations of moderate strength (closer to strong) with all total (length, mass, and body surface area) and longitudinal body dimensions (height of anthropometric points). Most of the spirographic indicators of this group had relationships with individual girth measurements, in particular hips, legs, waist, hips, feet, chest, ectomorphic component of the somatotype, muscle, bone and fat mass of the body. Thus, in YW with a mesomorphic somatotype, an increase in the longitudinal dimensions and weight of the body and its individual components will lead to an increase in indicators of the vital capacity of the lungs and inspiratory capacity at rest and under stress. Our results do not contradict the data of the study by M. Jibril and co-authors [9], where it is stated that spirographic parameters that reflect lung function are interrelated with body length and weight, the component composition of body weight.

Lung volumes determined by spirography in YW of mesomorphic somatotype had non-numerical significant correlations (all correlations are direct, of medium strength, closer to weak) with indicators of external body structure. In particular, the volume of forced exhalation in the first second had only unreliable average correlations with total body dimensions, and the residual volume of exhalation was correlated with the value of 14 (28.57 %) indicators of external body structure, of which only 4 were reliable.

Rapid spirographic indicators in practically healthy adolescent YW of mesomorphic somatotype had isolated statistically significant correlations with anthropo-somatotypological parameters. The vast majority of significant correlations were inverse. Unlike the previous group of spirometric parameters, all speed indicators were correlated with skinfold thickness. Skinfold thickness on the abdomen was interrelated with the value of almost all indicators of this group, with the exception of volumetric expiratory velocity, respectively, at 25 % of FVC. Scientists discovered a relationship between spirometric indicators and body fat mass, anterior-posterior abdominal size, and the amount of water in the human body [5, 15, 24]. According to the results of our research, it can be predicted that an increase in subcutaneous fat deposition, in particular, skinfold thickness on the abdomen in mesomorph YW will lead to a decrease in high-speed spirometric indicators.

It should be noted that the maximum peak exhalation flow in YW mesomorphs is directly related to the value of skinfold thickness under the shoulder blade and on the forearm, as well as to the value of the endomorphic and mesomorphic components of the somatotype. In a study by X. Tang and co-authors [23] among adults who do not smoke, it was found that obesity does not affect most spirometric indicators, except for the maximum peak expiratory flow, which was also confirmed by the results of our study.

Thus, the correlations established by us between indicators of external respiration and somatometric parameters confirm the previously known facts of the relationship between visceral indicators and constitutional features, which is important for establishing reference values of individual structural components of human body systems [9, 10, 19, 20].

Thus, an integral part of the scientific and practical monitoring of the state of health should be the assessment of respiratory function, the peculiarities of the relationship between spirographic and anthropometric indicators, which will make it possible to conduct statistical modeling in the future in order to establish the proper parameters of external breathing in persons of a certain sex and somatotype.

Conclusion

1. Established relationships between anthropo-somatotypological parameters and spirographic indicators in practically healthy YW mesomorphic constitutional type Podilia of the region of Ukraine.

2. Among the spirographic indicators, lung capacity had the greatest strength (r = 0.30 - 0.62) and the number (from 28.57 % to 48.98 % of all possible) of significant correlations with constitutional characteristics. Vital capacity at rest had the largest number and strength of correlations. Total, longitudinal and girth body dimensions, the ectomorphic component of the somatotype, muscle, bone and fat mass of the body were most often correlated with the capacity indicators of external respiration.

3. Other spirographic indicators in practically healthy YW mesomorphic somatotype had isolated statistically significant correlations with anthropo-somatotypological parameters. All speed spirographic indicators and maximum peak expiratory flow were correlated with skinfold thickness.

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ОСОБЛИВОСТІ ВЗАЄМОЗВ'ЯЗКІВ МІЖ СПІРОМЕТРИЧНИМИ ТА АНТРОПОМЕТРИЧНИМИ ПОКАЗНИКАМИ У ПРАКТИЧНО ЗДОРОВИХ ДІВЧАТ МЕЗОМОРФНОГО СОМАТОТИПУ

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Актуальним залишається питання вивчення взаємозв'язків між показниками зовнішньої будови тіла та спірографічними параметрами в осіб певної статі, віку, етно-територіального районування, особливо з позиції необхідності визначення референтних значень показників зовнішнього дихання. Метою дослідження було визначення особливостей взаємозв'язків між спірографічними параметрами та показниками зовнішньої будови тіла у практично здорових дівчат юнацького віку мезоморфного конституціонального типу Подільського регіону України. Провели комплексне клініко-лабораторне дослідження осіб жіночої статі у віці від 16 до 20 років, що відповідає юнацькому періоду онтогенезу. Було відібрано 109 практично здорових дівчат, у яких не виявлені відхилення у стані здоров'я за результатами рентгенографії, ехокардіографії, тетраполярної реовазографії та реоенцефалографії, сонографічного дослідження паренхіматозних органів черевної порожнини та щитоподібної залози, загального та біохімічного аналізу крові. Даній групі досліджуваних ми провели спірографічне обстеження на апараті Medgraphics Pulmonary Function System 1070 series за методикою Американської асоціації пульмонологів та Європейського респіраторного товариства (2019). Антропометричне дослідження провели за методом В. В. Бунака (1941), соматотипологічне - за розрахунковою модифікацією метода Heath-Carter (1990). Оцінку компонентного складу маси тіла провели за методом Матейко (1921). Після соматотипування було виявлено, що у 32 дівчат був мезоморфний тип конституції, для них був проведений кореляційний аналіз за Спірменом у ліцензійному програмному пакеті "Statistica 5.5". Встановлено, що більшість спірографічних показники у практично здорових дівчат юнацького віку мезоморфного соматотипу мали поодинокі статистично значущі кореляції з антропо-соматотипологічними параметрами, за винятком параметрів, які відображають легеневі ємності. Показник життєвої ємності в стані спокою мав найбільшу кількість і силу кореляцій, він був значуще пов'язаний із величинами 24 антропо-соматотипологічних показників. Найчастіше з ємнісними показниками зовнішнього дихання корелювали тотальні, поздовжні та обхватні розміри тіла, ектоморфний компонент соматотипу, м'язова, кісткова та жирова маси тіла. Всі швидкісні спірографічні показники та максимальний піковий потік видиху корелювали з товщиною шкірно-жирових складок. Вивчення кореляційних зв'язків є підґрунтям подальшого математичного моделювання для визначення належних спірографічних показників у окремої представниці жіночої статі юнацького віку мезоморфного соматотипу.

Ключові слова: *спірометрія, антропометрія, мезоморфний соматотип, кореляція, дівчата, юнацький вік.*