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Central hemodynamic parameters in girls and boys with different body types

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Abstract. The somatotypological determination of central hemodynamic parameters is of significant importance for predicting susceptibility to and the course of cardiovascular diseases, as well as athletic performance. However, there is a lack of information on the somatotypological status of hemodynamic parameters in otherwise healthy individuals, which could serve as baseline values for comparison in clinical studies of various types. The aim of the study was to establish the somatotypological characteristics of central hemodynamic parameters, determined using tetrapolar rheovasography, in healthy urban adolescents residing in the Podillia region of Ukraine. Anthropometric, somatotypological, and rheographic studies were conducted on 168 healthy young men (aged 17 to 21) and 167 healthy young women (aged 16 to 20) who have resided in the Podillia region of Ukraine for three generations. Somatotyping was performed according to Heath-Carter, whereby the girls were divided into 6 groups: endomorphs (n=11), mesomorphs (n=40), ectomorphs (n=38), ecto-mesomorphs (n=20), endo-mesomorphs (n=25), girls with an intermediate somatotype (n=33), and the boys into 5 groups: mesomorphs (n=69), ectomorphs (n=25), ecto-mesomorphs (n=30), endo-mesomorphs (n=11); boys with an intermediate somatotype (n=20). The analysis of the results was performed using the STATISTICA 5.5 software. The study identified constitutional differences in central hemodynamic parameters; specifically, among ecto-mesomorphic girls, stroke volume, cardiac output, stroke index, cardiac index, left ventricular ejection fraction, and left ventricular power were the highest, while in endo-

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mesomorphs, most of these parameters had the lowest values. Specific and total peripheral resistance were highest in endomorph girls, while these parameters were lowest in endo-mesomorphs. Among mesomorphic boys, the highest values of blood pressure, stroke volume, left ventricular power, and energy expenditure were found, while ectomorphs had the lowest values for these parameters. In boys of certain somatotypes, central hemodynamic parameters were significantly higher than in girls. Individuals with ectomorphic and ecto-mesomorphic somatotypes showed no gender differences in specific central hemodynamic parameters. The central hemodynamic parameters we determined can be considered as baseline normative values.

Keywords: central hemodynamics; tetrapolar rheography; somatotype; adolescent age; sexual dimorphism.

INTRODUCTION

An integral characteristic of a person's somatic status is their constitution or somatotype, and according to D. S. Avabde et al. [1], the use of a constitutional approach in studying the morpho-functional indicators of individual body systems is appropriate and promising. This is confirmed by the works of other authors, who note that constitution is a multidimensional, integrative, and comprehensive characteristic of a person that is closely interrelated with their state of health [2, 3]. Researchers, notably A. Cowie et al. [4] and X. Liang et al. [5], have demonstrated that there is an interdependent relationship between constitutional features of external body structure and susceptibility to and the course of cardiovascular diseases. Y. Wang et al. [6] note that human constitution must be considered from the perspective of internal metabolism and resistance to external pathogenic factors. They demonstrated the existence of links between human constitution and cardiovascular diseases and linked constitutional characteristics to lifestyle and the risk of developing cardiovascular diseases. In studies by S. Singh et al. [7], correlations were found between the onset and course of hypertension in Indian residents and body mass index, waist and hip circumferences, and type of obesity, and it was demonstrated that abdominal obesity was directly proportional to high blood pressure. The authors attribute the development of hypertension in obese individuals to the fact that an increase in body weight leads to an increase in stroke volume and, simultaneously, in peripheral resistance in the arterioles [7].

For modern scientists, the existence of correlations between specific parameters of body conformation and cardiovascular system indicators is undisputed [8]. O.P. Khatitskaya studied the characteristics of peripheral hemodynamic parameters in the thigh and lower leg among male athletes of various somatotypes who specialized in track and field, volleyball, and wrestling [9]. In general, the issue of somatotypological determinants of cardiovascular system parameters is raised in sports medicine practice, which is of significant importance for athletic performance, since the parameters of this particular system are capable of significant variation depending on the specifics of the sport and the athlete's constitutional characteristics [10–12].

However, there is a lack of information on the somatotypological status of hemodynamic parameters in otherwise healthy individuals, which could serve as baseline values for comparison in clinical studies of various kinds. Thus, the need to establish modern reference ranges for rheocardiographic parameters in healthy young women and men of the Ukrainian ethnic group and to address the issue of the characteristics of central hemodynamic parameters in individuals with a specific somatotype determines the relevance of this study.

The aim of the study: to establish the somatotypological characteristics of central hemodynamic parameters, determined using tetrapolar rheovasography, in essentially healthy urban adolescents residing in the Podillia region of Ukraine.

MATERIALS AND METHODS

Following a preliminary questionnaire regarding any history of medical conditions, we conducted a comprehensive examination of 247 young men aged 17 to 21 and 235 young women aged 16 to 20. All of them were urban residents of the Ukrainian ethnic group who are third-generation residents of the Podillia region of Ukraine. Young men and women in whom any medical conditions were detected were excluded from the group of healthy individuals. Thus, the group of practically healthy individuals consisted of 168 young men and 167 young women. Rheographic parameters were determined using a computerized diagnostic system capable of simultaneously recording an electrocardiogram, phonocardiogram, basic and differential tetrapolar rheogram, and measuring blood pressure. The portable multifunctional device was developed by staff at VNTU and the Research Center of the M. I. Pirogov Vinnitsa National Medical University. Somatotyping was performed using a modified version of the Heath-Carter method [13]. After determining the somatotypes, the girls were divided into 6 somatotypological groups: endomorphs (n=11), mesomorphs (n=40), ectomorphs (n=38), ecto-mesomorphs (n=20), endo-mesomorphs (n=25), girls with an intermediate somatotype (n=33); the boys were divided into 5 groups: mesomorphs (n=69), ectomorphs (n=25), ecto-mesomorphs (n=30), endo-mesomorphs (n=11); boys with an intermediate somatotype (n=20).

The results were analyzed using STATISTICA 5.5 (license No. AXXR910A374605FA) with nonparametric methods for evaluating the indicators. Differences between the compared samples were determined using the Mann-Whitney U test (when assessing somatotypological and gender differences between girls and boys of a specific somatotype).

The Bioethics Committee of the M. I. Pirogov Vinnitsa National Medical University determined that this study does not violate fundamental bioethical norms (Protocol No. 1 dated January 31, 2021).

RESULTS AND DISCUSSION

We found that there were no statistically significant differences in systolic blood pressure readings among adolescent girls belonging to different somatotypes. Among adolescent boys, the highest values of this indicator were recorded in the mesomorph group, and the lowest in the ectomorph group. A significant difference in systolic blood pressure was found among adolescent boys with these somatotypes ($p<0.05$).

When comparing systolic blood pressure values between girls and boys belonging to the same somatotype group, we found statistically significant gender differences in all groups. In boys, this indicator was statistically significantly higher compared to adolescent females (Table).

There were no significant differences in diastolic and mean arterial pressure values among girls with different somatotypes. In mesomorphic boys, these indicators were statistically significantly higher than in boys with an ectomorphic somatotype. Among other groups of adolescent boys, the somatic differences were not significant.

We found statistically significant gender differences in diastolic blood pressure when comparing adolescents with mesomorphic and ecto-mesomorphic somatotypes. In individuals with an endo-mesomorphic body type,

Table. Gender differences in indicators of central hemodynamics in young people with different somatotypes (M±σ)

Indicators	Somatotype	Girls	Boys	p
Systolic blood pressure (mmHg)	mesomorphic	117,8±12,2	129,3±12,9	**<0,001**
	ectomorphic	114,1±11,1	122,4±13,4	**<0,05**
	ecto-mesomorphic	116,0±11,9	124,9±13,6	**<0,05**
	endo-mesomorphic	113,2±11,7	126,0± 8,6	**<0,01**
	intermediate	116,9±9,7	125,5±11,3	**<0,05**
Diastolic blood pressure (mmHg	mesomorphic	72,27±10,7	79,92±8,9	**<0,001**
	ectomorphic	71,80±8,01	74,16±11,22	>0,05
	ecto-mesomorphic	70,50±10,18	77,32±11,48	**<0,05**
	endo-mesomorphic	69,32±10,98	77,30±8,65	**=0,057**
	intermediate	72,29±6,30	76,16±6,52	>0,05
Average blood pressure (mmHg)	mesomorphic	87,15±9,50	96,03±8,86	**<0,001**
	ectomorphic	85,52±8,48	89,88±11,24	>0,05
	ecto-mesomorphic	85,40±9,99	92,87±11,37	**<0,05**
	endo-mesomorphic	83,60±10,50	93,3±8,0	**<0,05**
	intermediate	86,90±6,57	92,22±7,06	**<0,05**
Stroke blood volume (ml)	mesomorphic	73,81±23,36	94,30±21,08	**<0,001**
	ectomorphic	69,77±19,11	84,46±20,10	**<0,01**
	ecto-mesomorphic	82,48±23,58	89,75±21,88	>0,05
	endo-mesomorphic	62,03±14,41	96,01±20,84	**<0,001**
	intermediate	71,23±19,97	88,40±19,40	**<0,01**
Minute blood volume (l)	mesomorphic	4,860±1,684	5,134±0,969	**<0,05**
	ectomorphic	4,622±1,359	4,969±1,314	>0,05
	ecto-mesomorphic	5,243±1,479	5,261±1,267	>0,05
	endo-mesomorphic	4,171±0,872	5,427±1,126	**<0,01**
	intermediate	4,382±1,000	5,157±1,01	**<0,05**
Impact index (ml/m^2)	mesomorphic	45,17±13,64	50,28±11,18	**<0,01**
	ectomorphic	44,50±12,03	46,68±11,11	>0,05
	ecto-mesomorphic	51,80±13,10	49,12±13,01	>0,05
	endo-mesomorphic	38,72±10,13	49,20±10,65	**<0,05**
	intermediate	43,80±11,51	46,27±9,34	>0,05
Cardiac index (l/min/m^2)	mesomorphic	3,002±0,943	2,766±0,522	>0,05
	ectomorphic	2,981±0,862	2,789±0,792	>0,05
	ecto-mesomorphic	3,322±0,838	2,905±0,745	>0,05
	endo-mesomorphic	2,632±0,603	2,807±0,572	>0,05
	intermediate	2,734±0,572	2,726±0,454	>0,05

Continuation of the table

Indicators	Somatotype	Girls	Boys	p
Specific peripheral resistance (Dyn/s/cm-5)	mesomorphic	31,41±8,87	35,99±8,00	**<0,001**
	ectomorphic	30,95±9,22	34,72±10,61	>0,05
	ecto-mesomorphic	26,98±6,19	33,73±9,01	>0,05
	endo-mesomorphic	33,22±8,14	34,32±6,77	>0,05
	intermediate	33,46±9,34	34,45±4,49	>0,05
Total peripheral resistance (Dyn/s/cm-5)	mesomorphic	1569,9±457,7	1552,9±351,4	>0,05
	ectomorphic	1589,3±447,3	1544,3±441,3	>0,05
	ecto-mesomorphic	1385,5±351,4	1480,7±377,9	>0,05
	endo-mesomorphic	1662,2±367,1	1418,9±269,6	>0,05
	intermediate	1682,0±491,7	1470,8±240,5	>0,05
Volumetric speed of movement (ml/s)	mesomorphic	271,3±85,6	352,4±73,0	**<0,001**
	ectomorphic	258,9±65,1	322,9±71,1	**<0,01**
	ecto-mesomorphic	294,9±81,80	336,7±72,7	>0,05
	endo-mesomorphic	229,8±50,4	360,5±68,3	**<0,001**
	intermediate	258,0±65,7	331,8±68,5	**<0,001**
Left ventricular power (W)	mesomorphic	3,152±1,031	4,508±1,017	**<0,001**
	ectomorphic	2,956±0,845	3,866±0,981	**<0,001**
	ecto-mesomorphic	3,375±1,083	4,190±1,170	**<0,05**
	endo-mesomorphic	2,574±0,702	4,489±0,954	**<0,001**
	intermediate	2,988±0,799	4,110±1,045	**<0,001**
Energy consumption (W/l)	mesomorphic	0,195±0,021	0,216±0,021	**<0,001**
	ectomorphic	0,191±0,019	0,201±0,028	**<0,05**
	ecto-mesomorphic	0,189±0,021	0,209±0,026	**<0,05**
	endo-mesomorphic	0,185±0,024	0,215±0,018	**<0,01**
	intermediate	0,192±0,013	0,211±0,024	<0,01

Note: p is an indicator of statistically significant difference between girls and boys with the same somatotype.

the increase in diastolic blood pressure among boys was a trend (p=0.051). Mean arterial pressure showed no significant gender differences only in individuals with an ectomorphic body type; in adolescent males of other somatotypes, this indicator was statistically significantly higher than in females. It is noteworthy that the most pronounced gender differences in all types of blood pressure are observed in individuals with a mesomorphic body type (see Table).

Stroke volume was highest in girls with an ecto-mesomorphic body type, while the lowest value for this parameter was observed in endo-mesomorphs. Girls with an ecto-mesomorphic somatotype had a significantly higher stroke volume than girls with endo-mesomorphic (p<0.01) and ectomorphic (p<0.05) somatotypes. Meso-morphic girls also had a statistically significant (p<0.05) higher value of this indicator than endo-meso-morphic girls. Boys with a mesomorphic somatotype had a significantly higher (p<0.05) stroke volume than boys with ectomorphic and ecto-mesomorphic somatotypes.

We found that stroke volume was significantly higher in boys with mesomorphic, endo-mesomorphic, ectomorphic, and intermediate somatotypes than in girls of the corresponding constitutional types (see Table).

Minute blood volume was significantly higher in girls with an ecto-mesomorphic somatotype compared to those with an endo-mesomorphic type (p<0.05); among other somatic groups of adolescent females, the difference was not significant. In adolescent males with different somatotypes, this indicator was nearly at the same level, and there were no significant differences. It is noteworthy that the most pronounced sex differences in the magnitude of all types of blood pressure are observed in individuals with a mesomorphic somatotype (see Table).

It was found that the impact index differed significantly between girls with different types of body structure. The highest values were found in girls with ecto-mesomorphic somatotype, the lowest – with endo-mesomorphic and endomorphic. Ecto-mesomorph girls had a significantly higher given parameter than females with endomorphic, mesomorphic, intermediate intermediate (in all cases p<0.05) and endo-mesomorphic (p<0.001) somatotypes, and between ecto-mesomorph and ectomorph girls this feature remained in the form of a trend (p=0.057). In addition, it was established that females with ectomorphic and mesomorphic somatotypes had higher shock index values (p<0.05) than girls with endo-mesomorphic type, and between the latter and girls with an average balanced type, this pattern also had the appearance of a trend. We found no significant differences in the value of the impact index in young men of different constitutional types. It

was established that only boys with mesomorphic and endo-mesomorphic somatotypes have this indicator significantly higher than girls of the corresponding somatic groups (see Table).

The cardiac index value was the highest in girls with ecto-mesomorphic somatotype, significant differences were established between them and girls with endomorphic ($p<0.01$), endo-mesomorphic ($p<0.01$) and average intermediate somatotypes ($p<0.05$). This indicator was the lowest in endomorph girls, and the highest in mesomorphs, the differences between these groups were not significant when compared at $p=0.055$. In adolescent boys of different somatic groups, there was no significant difference in the value of this parameter.

The cardiac index between the groups of girls and boys of a particular somatotype had no significant gender difference (see Table).

The highest specific peripheral resistance was found in girls with an endomorphic type of body structure, the smallest – with an ecto-mesomorphic somatotype, a significant difference was established between these groups ($p<0.01$), in addition, a statistically significant decrease in this indicator was noted in ecto-mesomorphs compared to endo-mesomorphs ($p<0.05$) and girls with an average intermediate somatotype ($p<0.01$), relative to girls with a mesomorphic somatotype, this feature can be traced in the form of a trend. In adolescent boys of different somatotypes, there are no significant differences in the value of this indicator. We established reliable gender differences in the value of the specific peripheral resistance only in one group – in persons with mesomorphic somatotype, it is greater in boys ($p<0.001$) than in girls (see Table).

Girls with an ecto-mesomorphic somatotype had the lowest total peripheral resistance, a significant difference was established between them and endo-mesomorphs ($p<0.05$) and girls with an average intermediate somatotype ($p<0.05$).In adolescent boys of different somatotypes, there are no significant differences in the value of this indicator. We did not establish reliable gender differences in total peripheral resistance in all somatotypological groups (see Table).

We found that only girls with an endo-mesomorphic somatotype had a significantly lower volumetric velocity of blood movement compared to girls with mesomorphs ($p<0.05$) and ecto-mesomorphs ($p<0.01$). In adolescent boys of different somatic groups, there is no significant difference in the value of this parameter.

The volumetric speed of blood movement had pronounced gender somatotypological differences, in almost all somatic groups this indicator was significantly higher in boys, only in girls and boys with ecto-mesomorphic somatotype there were no statistically significant differences (see Table).

The power of the left ventricle was the smallest in girls with an endo-mesomorphic somatotype, significant differences were established between them and mesomorph ($p<0.05$) and ecto-mesomorph ($p<0.01$) girls. It was established that boys with a mesomorphic somatotype have significantly greater left ventricular power than boys with an ectomorphic somatotype ($p<0.01$). This indicator is characterized by pronounced sexual dimorphism with a predominance of values in boys in all somatotypological groups (see Table).

Indicators of energy expenditure in girls of different somatotypes did not differ statistically significantly. In young men with a mesomorphic type of body structure, this indicator is significantly higher than in boys with ectomorphs ($p<0.01$) and ecto-mesomorphs ($p<0.05$).We have established that male persons with any somatotype have statistically significantly higher energy expenditure than female representatives of the corresponding constitutional type (see Table).

Thus, the variability of the parameters of central hemodynamics is affected by the morpho-functional features of the body structure, which can be attributed to the morphological constitution of a person, i.e., his somatotype [14–16], because in our study it was found that in adolescent girls, most indicators of central hemodynamics, with the exception of blood pressure and energy expenditure, are reliably different in individuals with different types of body structure. We found that girls with an ecto-mesomorphic somatotype had the highest values of stroke and minute blood volumes, stroke and heart indices, volumetric speed of movement and power of the left ventricle compared to the indicators of persons of other somatotypes; the smallest value above the listed indicators, with the exception of the cardiac index, was established by us in the group of girls with endo-mesomorphic somatotype. Specific and total peripheral resistance are the highest in endomorph girls, in females with an ecto-mesomorphic somatotype, these indicators have statistically significantly lower values compared to girls of other constitutional groups. Studying the parameters of central hemodynamics in volleyball players of a high level of skill, it was found that compared to non-athletes of the same age, stroke and minute blood volumes, stroke index, volume velocity, and left ventricular power were statistically significantly higher in them [17].

Most of the indicators of central hemodynamics, determined by us using the method of tetrapolar reocardiography, did not have reliable somatotypological differences in adolescent boys.The highest values of blood pressure, stroke volume, left ventricular power and energy expenditure were found in boys with mesomorphic somatotype, the lowest in ectomorph boys. The fact that these indicators did not reliably differ between young men with other constitutional types also attracts attention.

Scientists drew attention to the fact that representatives of certain somatotypes, even within the same sport, have differences in the indicators of the cardiovascular system. Thus, changes in indicators of heart rate variability were found in mesomorphic somatotype track and field athletes compared to young men of the same constitutional type who did not play sports [10] and mesomorphic volleyball players compared to mesomorphic somatotype non-athletes [11].

In addition, it was established that the following electrocardiographic parameters were significantly higher in young male athletes who belonged to the mesomorphic somatotype, compared to athletes of other somatotypes: the duration of the P wave, the QT and RR intervals, as well as the amplitude of the P, R, T waves [18]. Scientific studies have proven that in individuals with a preference for the expression of the mesomorphic component of the somatotype, most of the mofro-functional indicators of central [19] and peripheral [20] hemodynamics had either a tendency to higher values or were significantly higher compared to representatives of other somatotypes. In the study of P. V. Sarafynyuk and I. D. Kuhar [21] it was found that practically healthy teenagers of the mesomorphic somatotype of the Podil region of Ukraine had the highest values of echocardiographic parameters of the heart.So, the reliable predominance of rheovasographic parameters of central hemodynamics in practically healthy young boys with mesomorphic somatotype revealed in our study is well-founded, confirmed by numerous scientific works of this direction.

The use of the somatotypological approach in this work confirmed the presence of sexual dimorphism in the value of central hemodynamic parameters [22, 23]. Comparison of systolic, diastolic, and average blood pressure, stroke volume, volumetric velocity of blood movement, left ventricular power, and energy expenditure between adolescent girls and boys who belonged to a certain somatotype made it possible to conclude that the values of diastolic and average arterial pressures and minute blood volume do not have reliable gender differences in individuals with an ectomorphic somatotype. and stroke and minute volumes and volume speed of blood movement do not reliably differ in individuals with ecto-mesomorphic somatotype. We can assume that an increase in the value of the ectomorphic component of the somatotype, which reflects the relative linearity or elongation of the body, eliminates gender differences in individual indicators of central hemodynamics.

The need for constant control of the functional state of the cardiovascular system is emphasized in their studies by D. Berhtraum et al. [24] and T. Shevchuk et al. [25], emphasizing the significance of the updated regulations

Thus, the detection of hemodynamic heterogeneity in people with different body types requires the latest constitutional approaches to the assessment and interpretation of the obtained results of central hemodynamic indicators.

CONCLUSIONS

Somatotypological regularities of changes in central hemodynamic parameters, obtained by the method of tetrapolar reocardiography, in practically healthy urban youth of the Podilsk region of Ukraine, taking into account the factor of sexual determinism, were established. It was established that the vast majority of indicators of central hemodynamics in youth have pronounced somatotypological differences. They differ the most in girls with endo-mesomorphic, ecto-mesomorphic, endomorphic somatotypes. In ecto-mesomorph girls, stroke and minute volumes of blood, stroke and cardiac indices, volume speed of movement and power of the left ventricle have the greatest values; the lowest value was established in the group of girls with endo-mesomorphic somatotype. The indicators of specific and total peripheral resistance are the highest in endomorph girls, the lowest in girls with an ecto-mesomorphic somatotype. Compared to other constitutional groups, boys with a mesomorphic somatotype had the highest blood pressure, stroke volume, left ventricular power, and energy expenditure, while boys with an ectomorphic somatotype had the lowest values of these parameters.

It was established that in practically healthy urban young men of certain somatotypes, most indicators of central hemodynamics are reliably higher than in girls. Exceptions are only individuals with ectomorphic and ecto-mesomorphic somatotypes, in which there are no gender differences in individual indicators of central hemodynamics (diastolic, mean arterial pressure, minute and stroke volume of blood, volume velocity of blood movement).

Our application of the somatotypological approach to the study of normative rheographic parameters of central hemodynamics will allow us to improve the criteria for a more precise distinction between normality and pathology, which in turn will make it possible to more precisely approach the issue of early detection of risk groups and predict diseases of the organs of the cardiovascular system.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Показники центральної гемодинаміки у дівчат і юнаків із різними соматотипами

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Анотація. Соматотипологічна зумовленість показників центральної гемодинаміки має вагоме значення для прогнозування схильності та перебігу захворювань серцево-судинної системи, а також спортивних досягнень. Але відчувається недостатність інформації про соматотипологічний стан гемодинамічних показників у практично здорових осіб, які можна використати як базові значення для порівняння у клінічних дослідженнях різного спрямування. Метою роботи було встановлення соматотипологічних особливостей показників центральної гемодинаміки, визначених за допомогою тетраполярної реовазографії, у практично здорових міських осіб юнацького віку – мешканців Подільського регіону України. Було проведено антропометричне, соматотипологічне та реографічне дослідження практично здорових 168 юнаків (віком від 17 до 21 року) і 167 дівчат (від 16 до 20 років), які у третьому поколінні проживають на території Подільського регіону України. Соматотипування проводили за Heath-Carter, за яким дівчат поділили на 6 груп: ендоморфи (n=11), мезоморфи (n=40), ектоморфи (n=38), екто-мезоморфи (n=20), ендо-мезоморфи (n=25), дівчата із середнім проміжним соматотипом (n=33). Юнаків теж поділили на 5 груп: мезоморфи (n=69), ектоморфи (n=25), екто-мезоморфи (n=30), ендо-мезоморфи (n=11); хлопці із середнім проміжним соматотипом (n=20). Проаналізували отримані результати за допомогою програми STATISTICA 5.5. Встановлені конституціональні особливості параметрів центральної гемодинаміки, зокрема у дівчат-екто-мезоморфів ударний і хвилинний об'єми крові, ударний та серцевий індекси, об'ємна швидкість руху та потужність лівого шлуночка мали найвищі значення, а в ендо-мезоморфів величина більшості даних показників мала найменші значення. Питомий і загальний периферичний опір були найбільшими в дівчат-ендоморфів, у ендо-мезоморфів дані показники найменші. В юнаків-мезоморфів виявлено найбільшу величину артеріального тиску, ударного об'єму, потужності лівого шлуночка та витрат енергії, а в ектоморфів були найменші значення даних показників. У юнаків окремих соматотипів параметри центральної гемодинаміки достовірно вищі, ніж у дівчат. Особи з ектоморфним та екто-мезоморфним соматотипами не мали статевих відмінностей між окремими показниками центральної гемодинаміки, які можна розглядати як базові нормативні значення.

Ключові слова: центральна гемодинаміка; тетраполярна реогрфія; соматотип; юнацький вік; статевий диморфізм.