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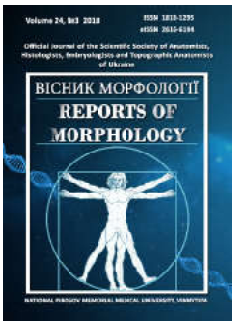

Features of total body sizes and anthropometric torso sizes in female volleyball players of mesomorphic somatotype

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Determination of constitutional parameters that are inherent in highly skilled athletes of a particular sport can serve as reliable predictive markers during sport selection. But the last time an indisputable fact is the somatotypological conditionality of individual sizes that characterize the external structure of the body, and the visceral structures of the organism. The purpose of the work is to establish differences in the anthropometric dimensions between young women volleyball players of high level of athletic skill and non-sports young women belonging to the mesomorphic somatotype. On the base of the research center of the National Pirogov Memorial Medical University, we conducted an anthropo-somatotypological study of 127 female volleyball players of youth age (from 16 to 20 years) with a high level of athletic skill. Sports experience in all cases was greater than 3 years. From the database of research center of the National Pirogov Memorial Medical University was selected 140 practically healthy young women of the same age who were not engaged in sports. Anthropometric measurements were carried out using the method of V.V. Bunak (1941), somatotypological research - according to the estimated modification of the Heath-Carter method (1990). After the conducted somatotyping, it was found that 29 volleyball players and 33 non-sports young women belonged to the mesomorphic type of constitution. The analysis of the obtained results is carried out in the licensed package of Statistica 5.5 using nonparametric methods of evaluation of indicators. In the volleyball players of the mesomorphic somatotype, compared to young women who are not engaged in sports of the same constitutional type, we have found a significantly larger length of the body, the mass and area of the body surface, the height of the suprasternal, pubic, shoulder anthropometric points, chest cords, transverse mid and lower chest and sagittal middle-thigh diameters, intervertebral distance of the pelvis and its external conjugates. Relatively smaller in female volleyball players of mesomorphic type of physique was the thickness of the skin-fat folds under the shoulder blade. One can conclude that within the same somatotype there are significant changes in the anthropometric parameters, in particular total body and longitudinal, transverse, front and rear body dimensions, which is affected by the body of modern young womenvolleyball players with mesomorphic somatotype, under the influence of intensive loads.

Keywords: *anthropometry, mesomorphic somatotype, female volleyball players, juvenile age.*

Introduction

Sports specialization is based on the adequacy of the biological capabilities of a person to the demands of their professional activities [13, 15, 22]. Reserves of the human body, which determine the possibility of achieving high results in sports, are far from exhausted. The question of the timely detection of children and adolescents susceptibility to certain types of motor activity has become relevant, as a result of their development and the growth of professional skills, they also have a sports individuality [12]. Therefore, rational system of sports selection creates favorable conditions for full disclosure of the potential of a young athlete and their improvement [3]. Early diagnostics of the features of the development of morphological characteristics and motor abilities of children in the process of sports selection is possible with the use of genetic markers [4, 8, 11]. The current practice of selecting young athletes takes into account their morphological and functional parameters [7, 9], which have a high degree of genetic determination. It is proved that

athletes with a certain set of constitutional traits have advantages in a separate sport [1, 2,16-18, 21, 23]. Therefore, the definition of constitutional parameters that are inherent to highly skilled athletes of a particular sport can serve as reliable prognostic markers during sports selection. But it is known that the representatives of the elite of a particular sport have a significant variability in the size of total and partial body sizes. This is especially true for representatives of sports games, whose anthropometric parameters are marked by a large variety.

In previous studies, we revealed the marked differences in many anthropometric body sizes and body mass components in volleyball players, compared to non-athletes [23], a significant difference was found in the parameters of the external structure of the body of volleyball players of different sporting roles [19]. These studies confirm the shape-forming effect of volleyball sports activities on the body of athletes. Reserves of the human body, which determine the possibility of achieving high results in sports, are far from exhausted [14, 20]. Therefore, from our point of view, it was interesting to get an answer to the question of whether the somatometric dimensions vary from the representatives of certain constitutional types under the influence of sports activities.

The *purpose* of the work is to establish differences in the anthropometric dimensions between young women volleyball players of high level of athletic skill and non-sports young women belonging to the mesomorphic somatotype.

Materials and methods

On the base of the research center of the National Pirogov Memorial Medical University, we conducted an anthropo-somatotypological study of 127 young women volleyball players of youth age (from 16 to 20 years) with a high level of athletic skill. Sports experience in all cases was greater than 3 years. From the database of research center of the National Pirogov Memorial Medical University was selected 140 practically healthy young women of the same age who were not engaged in sports. Anthropometric measurements were carried out using the method of V.V. Bunak [5]. All surveyed girls had a somatotypological study on the estimated modification of the Heath-Carter method [6]. After the conducted somatotyping, it was found that 29 young women volleyball players and 33 non-sports young women belonged to the mesomorphic type of constitution. A control group was created from persons not engaged in sports and belonging to the mesomorphic somatotype, from the volleyball players with mesomorphic somatotype the main group was created. The analysis of the obtained results is carried out in the licensed package of Statistica 5.5 using nonparametric methods of evaluation of indicators. The reliability of the difference between independent quantitative indicators was determined using the Man-Whitney U-criterion.

Results

We found that volleyball players of the mesomorphic somatotype have significantly higher body mass, body length, and body surface area than young women of the same constitutional type that are not involved in sports (in all cases $p<0.001$) (tabl. 1).

Table 1. Anthropometric total body dimensions in persons with mesomorphic somatotype (M± σ).

Anthropometric dimensions	Control group	Female volleyball players	p
Body weight (kg)	57.96±7.48	65.89±7.36	<0.001
Body length (cm)	160.4±6.6	169.3±5.7	<0.001
Body surface area (m^2)	1.601±0.131	1.757±0.120	<0.001

Table 2. Anthropometric sizes of the body in persons with mesomorphic somatotype (M±σ).

Anthropometric dimensions	Control group	Female volleyball players	p
Height of the suprasternal point (cm)	130.5±6.2	139.5±6.5	<0.001
Height of the pubic point (cm)	81.38±5.36	87.91±4.71	<0.001
Height of the shoulder point (cm)	133.0±6.9	141.7±6.5	<0.001
Waist circumference (cm)	67.83±5.28	70.22±5.01	<0.05
Girth of the chest on the inspiration (cm)	86.47±7.14	95.05±5.99	<0.001
Girth of the chest on the exhalation (cm)	79.41±6.37	85.95±6.34	<0.001
Girth of the chest at rest (cm)	82.07±6.60	89.95±6.29	<0.001
Transverse mid-chest (cm)	25.54±2.96	26.61±1.55	<0.001
Transverse lower chest (cm)	21.15±3.38	23.68±2.31	<0.001
Sagittal mid-chest (cm)	16.96±1.20	18.17±2.02	<0.05
Shoulder width (cm)	35.87±2.66	36.62±2.16	=0.092
Interspinous distance (cm)	24.84±1.77	25.03±2.06	>0.05
Intercristal distance (cm)	27.58±1.65	28.59±2.64	=0.067
Intertrochanteric distance (cm)	31.55±1.65	32.50±2.02	<0.05
External conjugate (cm)	18.55±1.05	19.60±1.76	<0.05
Thickness of the fold under the shoulder blade (mm)	10.39±3.25	8.838±2.268	<0.05
Thickness of the fold on the abdomen (mm)	10.47±4.08	10.76±3.55	>0.05
Thickness of the fold on the side (mm)	8.619±4.180	10.14±3.47	=0.081

It was found that young women volleyball players have significantly higher hematopoietic, pubic and shoulder points (in all cases $p<0.001$) than their peers of mesomorphic somatotype who are not involved in sports (tabl. 2). In young women volleyball players with a mesomorphic somatotype, the waist circumference ($p<0.05$) and thorax at inhalation, exhalation and rest (in all cases $p<0.001$) are higher than in the control group of young women. Transverse mid-chest and lower chest sizes of the chest in athletes are statistically significantly higher than in non-sportsmen ($p<0.001$). The front and rear middle-thigh diameter also has significantly higher values in comparison with the control ($p<0.05$). At

that time, we found that the acromial diameter of the chest, indicating the width of the shoulders, has a large mean value in the sample of volleyball players, although the difference in the comparison of athletes and young women who are not engaged in sports with a mesomorphic somatotype is unreliable.

Analyzing the anthropometric size of the ace, it was found that the intraosseous distance in the mesomorphic somatotype, engaged in and not engaged in sports, has no significant differences. At that time, the values of the intervertebral distance and external conjugates in volleyball players are significantly higher than in the control group young women ($p<0.05$). A tendency towards higher values ($p=0.067$) of the intervertebral distance in a group of volleyball players with a mesomorphic somatotype was established (tabl. 2).

It was established that volleyball players have a significantly lower thickness of skin and fat folds under the shoulder blade than young women in the control group, which also belong to the mesomorphic type of constitution ($p<0.05$) (tabl. 2). The thickness of the fold on the abdomen has no significant differences between the comparison groups. It should be noted that at volleyball players thickness of skin and fat folds on the side has higher average values than in the control, but we did not find statistically significant differences in the value of this indicator when comparing volleyball players and non-athletes.

Discussion

The high level of modern sports requires specific knowledge in the field of morphological and functional characteristics of the organism. The somatotypological approach was used in the study of the indicators of central [24] and peripheral [10] hemodynamics, and it was proved that representatives of a separate somatotype, engaged in a particular sport of high level of athletic skill, have significant differences in the parameters of the cardiovascular system compared with non-athletes of the same constitutional type.

After comparing external somatometric parameters, despite the fact that young women of adolescence of both studied groups belonged to a mesomorphic constitutional type, we found significant differences. In volleyball players the body is more massive, as evidenced by the significantly higher values of all of their total body size. Length, weight and surface area of the body are signs that must be taken into account when carrying out a prognostic and signing sporting selection in volleyball [19]. In previous studies, without division into somatotypes, it has also been proven that volleyball players have significantly higher total body sizes. It was found that the average body length in the general group of volleyball players was 9,4 cm larger than that of non-sportsmen, body weight - by 8,5 kg, body surface area - by 0,2 m^2 [23]. Approximately, the same tendency for the predominance of individual total body sizes in volleyball players persists in considering this problem from the standpoint of belonging to the mesomorphic somatotype.

We have found that volleyball players of mesomorphic somatotype have longitudinal trunk sizes, which can be judged by the height of anthropometric points, are significantly higher compared to young women of the same constitutional type who were not engaged in sports. And the volleyball players of the general group did not have a significant difference in the height of the pubic, shoulder and trochanteric points when compared with non-sportsmen [19]. We found that volleyball players of mesomorphic somatotype all the enveloping dimensions of the chest are significantly larger ($p<0.001$) than in the control. In volleyball players of the general group, compared with non-athletes, reliable differences were detected only for the girth of the chest on the inspiration ($p<0.05$) [23]. In addition, we found that most of the body diameters in athletes are statistically significantly higher than that of young women who are not engaged in sports. This refers to the transverse mid and lower dimensions of the chest, the anterior-posterior mid-thigh, the intervertebral distance and the anterior-posterior size of the pelvis, as evidenced by the value of the external conjugate. In volleyball players of the general group, the reliable differences ($p<0.05$) were characteristic only for indicators that characterized the transverse dimensions of the chest [23]. Regarding indicators of hypodermic fat delivery, it should be noted that volleyball players of the mesomorphic somatotype compared with the control group, the thickness of the fold under the shoulder blade is significantly lower, the abdomen has no significant differences, and on the side has larger mean values at $p> 0,05$. Volleyball players of the general group had less subcutaneous fat removal on the body than young women who were not engaged in sports, as evidenced by a significantly lower value of all skin and fat folds ($p<0.001$) [25]. Thus, we have found that within the same somatotype there are more significant changes in the anthropometric indices of the body, in particular the body, under the influence of intensive loads, which is undergoing the organism of modern volleyball players of the mesomorphic somatotype.

Using the somatotypological approach in the analysis of external parameters of the body will enable more accurate prediction of changes in the anthropometric parameters of volleyball players under the influence of training and competitive activities.

Conclusions

1. It has been established that volleyball players of mesomorphic somatotype, compared to girls who are not engaged in sports of the same constitutional type, have a significantly higher magnitude of length, mass and surface area of the body.

2. The vast majority of the anthropometric dimensions of the trunk (longitudinal, transverse, anterior and posterior) in young women volleyball players of the mesomorphic body type are significantly greater than that of the control group young women.

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ОСОБЛИВОСТІ ТОТАЛЬНИХ РОЗМІРІВ ТІЛА Й АНТРОПОМЕТРИЧНИХ РОЗМІРІВ ТУЛУБА У ВОЛЕЙБОЛІСТОК МЕЗОМОРФНОГО СОМАТОТИПУ

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Визначення конституціональних параметрів, які притаманні висококваліфікованим спортсменам окремого виду спорту, може виступати надійними прогностичним маркером при проведенні спортивного відбору. Але в останній час незаперечливим фактом є соматотипологічна обумовленість окремих розмірів, які характеризують зовнішню будову тіла, та вісцеральних структур організму. Мета роботи - встановити відмінності антропометричних розмірів між волейболістками високого рівня спортивної майстерності та неспортсменками, які належать до мезоморфного соматотипу. На базі науково-дослідного центру Вінницького національного медичного університету ім. М.І. Пирогова нами було проведене антропо-соматотипологічне дослідження 127 волейболісток високого рівня спортивної майстерності юнацького віку (від 16 до 20 років). Спортивний стаж у всіх випадках був більшим 3 років. Із бази даних науково-дослідного центру Вінницького національного медичного університету ім. М.І. Пирогова було відібрано 140 практично здорових дівчат аналогічного віку, які не займалися спортом. Антропометричне вимірювання проводили за методом В.В. Бунака (1941), соматотипологічне дослідження - за розрахунковою модифікацією метода Heath-Carter (1990). Після проведеного соматотипування встановили,

що 29 волейболісток та 33 дівчини, які не займалися спортом, належали до мезоморфного типу конституції. Аналіз отриманих результатів проведений у ліцензійному пакеті Statistica 5.5 з використанням непараметричних методів оцінки показників. Виявлено у волейболісток мезоморфного соматотипу порівняно з дівчатами, які не займаються спортом того ж конституціонального типу, достовірно більшу величину довжини, маси та площі поверхні тіла, висоти надгрудинної, лобкової, плечової антропометричних точок, обхватів грудної клітки, поперечних середньо- і нижньогрудного, сагітального середньогрудинного діаметрів, міжвертлюгової відстані таза та його зовнішньої кон'югати. Достовірно меншою у волейболісток мезоморфного типу статури була товщина шкірно-жирової складки під лопаткою. Можна зробити висновок, що у межах одного соматотипу відбуваються значні зміни антропометричних показників, зокрема тотальних розмірів тіла та поздовжніх, поперечних, передньо-задніх розмірів тулуба під впливом інтенсивних навантажень, яких зазнає організм сучасних волейболісток мезоморфного соматотипу.

Ключові слова: *антропометрія, мезоморфний соматотип, волейболістки, юнацький вік.*

ОСОБЕННОСТИ ТОТАЛЬНЫХ РАЗМЕРОВ ТЕЛА И АНТРОПОМЕТРИЧЕСКИХ РАЗМЕРОВ ТУЛОВИЩА У ВОЛЕЙБОЛИСТОК МЕЗОМОРФНОГО СОМАТОТИПА

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Определение конституциональных параметров, присущих высококвалифицированным спортсменам отдельного вида спорта, может выступать надежным прогностическим маркером при проведении спортивного отбора. Но в последнее время неоспоримым фактом является соматотипологическая обусловленность отдельных размеров, характеризующих внешнее строение тела, и висцеральных структур организма. Цель работы - установить различия антропометрических размеров между волейболистками высокого уровня спортивного мастерства и неспортсменками, относящихмися к мезоморфному соматотипу. На базе научно-исследовательского центра Винницкого национального медицинского университета имени Н.И. Пирогова нами было проведено антропо-соматотипологическое исследование 127 волейболисток высокого уровня спортивного мастерства юношеского возраста (от 16 до 20 лет). Спортивный стаж во всех случаях был более 3 лет. Из базы данных научно-исследовательского центра Винницкого национального медицинского университета им. М.И. Пирогова было отобрано 140 практически здоровых девушек аналогичного возраста, которые не занимались спортом. Антропометрическое измерение проводили по методу В.В. Бунака (1941), соматотипологические исследования - по расчетной модификации метода Heath-Carter (1990). После проведенного соматотипирования установили, что 29 волейболисток и 33 девушки, которые не занимались спортом, принадлежали к мезоморфному типу конституции. Анализ полученных результатов проведен в лицензионном пакете Statistica 5.5 с использованием непараметрических методов оценки показателей. Выявлено у волейболисток мезоморфного соматотипа по сравнению с девушками, которые не занимаются спортом того же конституционального типа, достоверно большую величину длины, массы и площади поверхности тела, высоты надгрудинной, лобковой, плечевой антропометрических точек, обхватов грудной клетки, поперечных средне- и нижнегрудного, сагиттального среднегрудинного диаметров, межвертельной дистанции таза и его внешней конъюгаты. Достоверно меньше у волейболисток мезоморфного типа телосложения была толщина кожно-жировой складки под лопаткой. Можно сделать вывод, что в пределах одного соматотипа происходят значительные изменения антропометрических показателей, в частности тотальных размеров тела и продольных, поперечных, передне-задних размеров туловища под влиянием интенсивных нагрузок, которые испытывает организм современных волейболисток мезоморфного соматотипа.

Ключевые слова: *антропометрия, мезоморфный соматотип, волейболистки, юношеский возраст.*