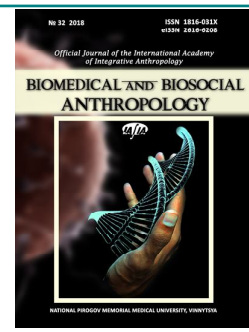




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Manifestations of asymmetry and correlations of sonographic parameters of the kidneys with constitutional parameters of the body in practically healthy men and women of different somatotypes

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The problem of asymmetry is one of the fundamental in modern biology, theoretical and clinical medicine, it has deep evolutionary roots. Analysis of literature suggests that the coverage of various aspects of morpho-functional asymmetry of the kidneys to this time is not always unambiguous, and sometimes controversial. The purpose of the work is to establish manifestations of asymmetry of entering into regression models of sonographic sizes of kidneys anthropometric and somatotypological parameters of a body in practically healthy women and men of different somatotypes. Within the framework of the agreement on scientific cooperation from the database of the research center of the National Pirogov Memorial Medical University, Vinnytsya taken the primary sonographic parameters, anthropometric and somatotypological indicators of 121 practically healthy women and 97 practically healthy men of the first mature age (correspondingly, of the age from 21 to 35 and from 22 to 35 years old) who in the third generation live on the territory of Podillia region of Ukraine. For the construction of regression models of individual sonographic sizes of the kidneys, depending on the peculiarities of anthropo-somatotypological parameters of the body, the license package "Statistica 6.1" was used. To analyze the asymmetry of entering into regression models of sonographic sizes of anthropo-somatotypological indicators, all constructed reliable models, but not only models with a determination coefficient of greater than 0.6, were taken into account. Also, in the analysis, anthropometric and somatotypological indicators refer either to highly genetically determined (longitudinal body sizes, cephalometric indexes, width of distal epiphyses of long tubular limb bones, trunk diameters, pelvic sizes, ectomorphic component of somatotype, bone component of body weight) or to low genetically determined (mass, body surface area, body dimensions thickness of skin fat folds, endomorphic and mesomorphic components of the somatotype, muscle and fat components of the body mass). In men of various somatotypes, when analyzing the asymmetry of entering the models of sonographic sizes of the anthropometric and somatotypological indicators of kidneys, it has been established: in the mesomorphic somatotype representatives - 84.1% (among which 50.0% belong to highly genetically determined indices), in the representatives of the ecto-mesomorphic somatotype - 86.0% (among which 46.5% belong to highly genetically determined indicators), in the representatives of the endo-mesomorphic somatotype - 88.1% (among which 51.4% belong to a highly genetically determined indices). In women of various somatotypes, when analyzing the asymmetry of entering the models of sonographic sizes of the anthropometric and somatotypological indicators of kidneys, it was established: in the representatives of the mesomorphic somatotype - 82.0% (among which 51.2% belong to highly genetically determined indices), in the representatives of the ectomorphic somatotype - 89.0% (among which 58.0% belong to highly genetically determined indicators), in the representatives of the endo-mesomorphic somatotype - 83.3% (among which 50.0% belong to highly genetically determined indicators), in the representatives of middle intermediate somatotype - 82.5% (among which 56.5% belong to highly

genetically determined indicators).

Keywords: *asymmetry, regression analysis, sonographic parameters of the kidneys, anthropometry, somatotype, practically healthy women and men.*

Introduction

The problem of asymmetry is one of the fundamental in modern biology, theoretical and clinical medicine, it has deep evolutionary roots. During individual development in the early stages, when the laying and formation of paired organs occurs, a certain degree of their asymmetry is necessarily formed. Paired organs practically are not strictly symmetrical: there are differences in mass, linear, volumetric dimensions, structure and functions. These features are manifested as a result of genetic (hereditary) influences, as well as social, climatogeographical and other environmental influences [21].

At present, the possibility of using the asymmetry of kidney sizes as a characteristic and criterion of morpho-physiological characteristics of populations is taken into consideration, which records the increase of the level of both directed and non-directed (fluctuating) asymmetry [41, 42].

If in most individuals in the population there is a predominance of any size on the one hand [41], then they refer to the directed asymmetry of organisms and paired organs. The fluctuating asymmetry is a non-directional oscillation of paired dimensions, when in different representatives of one population have some signs larger from the left, and in others - from the right side of the body.

Fluctuating asymmetry is also defined as a consequence of imperfection of ontogenetic processes and is a measure of the stability of the development of this group of individuals, that is, it is believed that this indicator is the property of a population, and not a certain individual. Non-directed, fluctuating character of asymmetry is associated with deterioration of penetrance and expressiveness of genes due to a whole set of causes of genetic nature [22]. The increase in the degree of fluctuating asymmetry is related due to the negative influence of exogenous factors on the development of the organism. The severity of this type of asymmetry depends on the type, intensity and duration of adverse factors on the one hand, and on the ability of the body to withstand adverse effects to stabilize the development process, regardless of the external effect [20, 41].

Asymmetry of the vascular system of the kidneys is described in many morphological works, especially the asymmetry of the extraorgan renal vessels and their large branches [17]. There is evidence that the left renal artery is shorter and more straightforward than right, and an enlarged blood circulation in the left renal artery can lead to a relative increase in its volume. Due to the inequality of renal blood flow between the kidneys, structural or functional differences may occur. The asymmetry of the size of the kidneys may also be related to the size of the liver, which impedes the vertical growth of the right kidney to the level achieved by the left kidney [24].

Analysis of literature suggests that the coverage of various aspects of morpho-functional asymmetry of the kidneys to this time is not always unambiguous, and sometimes controversial.

The *purpose* of the work is to establish manifestations of the asymmetry of entering into regression models of sonographic sizes of kidneys anthropometric and somatotypological parameters of a body in practically healthy women and men of different somatotypes.

Materials and methods

Within the framework of the agreement on scientific cooperation from the database of the research center of the National Pirogov Memorial Medical University, Vinnytsya taken the primary sonographic parameters and anthropometric indices of 121 practically healthy women and 97 practically healthy men of the first mature age (correspondingly, of the age from 21 to 35 and from 22 to 35 years) who in the third generation live in the Podillia region of Ukraine.

The standard definition of length, width, anterior-posterior size, longitudinal and cross-sectional area of the kidneys and their sinuses, as well as the volume of the right and left kidneys [25] was performed using the ultrasound diagnostic system "CAPASEE" SSA-220A (Toshiba, Japan), convex sensor with a working frequency of 3.75 MHz and a diagnostic ultrasound system Voluson 730 Pro (Austria), a convective sensor of 4-10 MHz.

An anthropometric survey was carried out by V. V. Bunak in the modification of P. P. Shaparenko [34] for all surveyed. The components of the somatotype and the type of somatotype were determined by the mathematical scheme of J. Carter and B. Heath [4]. The fat, bone and muscle mass components of the body were calculated according to the formulas J. Matiegka [23], as well as the muscular component of the body mass according to the formulas of the American Institute of Nutrition [33].

For the construction of regression models of individual sonographic sizes of the kidneys, depending on the peculiarities of anthropo-somatotypological parameters of the body, the license package "Statistica 6.1" was used.

Results

The regression models of sonographic sizes of the kidneys, depending on the peculiarities of anthropo-somatotypological parameters of the body of practically healthy men of mesomorphic, ecto-mesomorphic and endo-mesomorphic somatotypes, as well as practically healthy women of mesomorphic, ectomorphic, endo- mesomorphic and mean intermediate somatotypes were constructed and presented by us in the previous publications [5-7, 36-38]. To

analyze the asymmetry of entering the regression models of sonographic sizes of the anthropo-somatotypological indicators, we took into account all constructed reliable models, and not only models with a determination coefficient of greater than 0.6. Also, in the analysis, anthropometric and somatotypological indicators refer either to highly genetically determined (longitudinal body size, cephalometric indexes, width of distal epiphyses of long tubular limb bones, trunk diameters, pelvic sizes, ectomorphic component of somatotype, bone component of body weight) or to low genetically determined (mass, body surface area, girth body dimensions, thickness of skin folds, endomorphic and mesomorphic components of the somatotype, muscle and fat components of the body).

Discussion

Judging by the results of most studies, the asymmetry was inherent in the linear and volume dimensions of the kidneys [1, 3, 8, 9, 13, 15, 18, 26, 31, 37].

Exclusions were the results of a study conducted by Muthusami P., Ananthakrishnan R. and Santosh P. [27], which found that the right and left kidneys had similar lengths and widths. The ultrasound study of kidney sizes in the adult population of northeastern India in both sexes of different ages [10] also showed no significant differences in any size between the right and left kidneys in both sexes, although the size of the left kidney was slightly larger than to the right.

According to Shevchuk N. A. [36], both in boys and girls of different somatotypes, in the vast majority of cases, larger values are set for the left kidney. For the right kidney, larger values are set only for the area of the cross section of the kidney and its sinus.

According to Kovalenko D. A. [19], in the majority of cases on the longitudinal section of the kidneys, larger sizes of the left kidney are installed, and on the transverse section - of the right kidney in the persons of both sexes with different somatotypes.

The volume of the kidney is related to the area of the body surface according to Scholbach T. and Weitzel D. [33], the width of the kidney according to Musa M. J. and Abukonna A. [26] and Hammad L. F. [14], the length of the kidney and its gates according to the data of Otaboev S. I., Shadmanov A. K. and Rakhmatillaev T. B. [29] were higher on the right.

In other studies, sizes of the left kidneys prevailed over the right [8, 13, 18, 31, 37, 43]. The presence of asymmetry by the magnitude of sonographic parameters of the kidneys was inherent in a certain population and subpopulation and did not depend on their age and sex.

Several authors set an asymmetry both by the strength and quality of correlations of renal parameters with constitutional indices and regression equations built on their basis. So, Eze C. U. et al. [10], Okur A. et al. [28], Purohit K. et al. [30], Raza M., Hameed A., and Khan M. I. [31], Saeed Z. et al. [32] in both kidneys, different values of the Pearson correlation coefficients of their length with body parameters were determined.

Jabbari M. et al. [16] and Gavela T. et al. [11] found different values of the Pearson correlation coefficient of parenchyma thickness with weight, length and area of the body surface in both kidneys.

According to N. S. Bakharev and E. K. Gordeeva, [2] a greater number of strong and average strength connections for the parameters of the left kidney (length, thickness, width, thickness of parenchyma), than the right (only the thickness of the parenchyma) is established.

I. V. Gunas and others [12] found the asymmetry of the correlation connections of parameters of both kidneys with anthropo-somatotypological parameters: in men only for the left kidney with its thickness, length and thickness of the parenchyma on the border between the anterior upper and anterior lower segments, and for women - for the right kidney with its thickness, and for the left kidney - with its length and areas of the longitudinal section of the kidney and its sinus. In the study of both sexes, a greater number of reliable connections are established for the left kidney. The author constructed regression polynomials for the area of the cross section of the sinus and the index of the shape of the right kidney and the size of the parenchyma in the anterior segment of the left kidney in men, and in women - only for the area of the cross section of the sinus and the index of the shape of the right kidney. In men constructed regression polynomials of sonographic parameters of the right kidney most often include the thickness of skin and fat folds, and the left kidney - the width of the shoulders. In women, regression polynomials are constructed only for sonographic parameters of the right kidney.

In our studies, analyzing the asymmetry of entering to models sonographic sizes of the kidneys of anthropometric and somatotypological parameters in practically healthy men of different somatotypes was found: in the representatives of the mesomorphic somatotype - only 15.9% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which 57.1% belong to highly genetically determined indicators - longitudinal body dimensions, pelvic sizes and cephalometric indices), and 84.1% of anthropo-somatotypological indicators have manifestations of asymmetry (among which 50.0% relate to highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal epiphyses of long limb bones and cephalometric indices); in the representatives of the ecto-mesomorphic somatotype only 14.0% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which all relate to highly genetically determined indices - longitudinal body size, width of distal epiphyses of long limb tubes, pelvic sizes and cephalometric indices), and 86.0% anthropo-somatotypological indicators have manifestations of asymmetry (among which 46.5% are highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal epiphysis of long bones of limbs, cephalometric indicators, ectomorphic

somatotype component by Carter-Heath and bone components of body weight by Matiegka); in the representatives of the endo-mesomorphic somatotype - only 11.9% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which only 36.4% relate to highly genetically determined indices - in all cases, the anterior-posterior size of the chest), and 88.1% of the anthropometric and somatotypological indices have manifestations of asymmetry (among which 51.4% relate to highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal epiphyses of long limb tubular bones and cephalometric indicators).

In the analysis of the asymmetry of entering to the models sonographic sizes of the kidneys of anthropometric and somatotypological indicators in practically healthy women of different somatotypes, it is established: in the representatives of the mesomorphic somatotype - only 18.0% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which only 33.1% belong to highly genetically determined indicators - body diameters, cephalometric indices and bone component of body weight by Matiegka), and 82.0% of the anthropometric and somatotypological indices have manifestations of asymmetry (51.2% of which belong to the highly genetically determined parameters - longitudinal dimensions, diameters of the body, sizes of the pelvis, width of distal epiphysis of long bones of limbs, cephalometric performances and bone components of body weight by Matiegka); in the representatives women of the endo-mesomorphic somatotype - only 16.7% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which 57.1% relate to highly genetically determined indices - longitudinal dimensions of the body, pelvic sizes and cephalometric indices), and 83.3% of anthropo-somatotypological indices have manifestations of asymmetries (among which 50.0% belong to highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal epiphyses of long limb tubular bones, cephalometric performances and bone components of body weight by Matiegka); in the representatives women of the ectomorphic somatotype only 11.0% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which 80.0% belong to highly genetically determined indices - body diameters, pelvic sizes and cephalometric indices), and 89.0% of anthropometric and somatotypological indices have manifestations of asymmetry (of which 58.0% relate to highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal

epiphyses of long limb tubular bones, cephalometric indicators and bone component of body weight by Matiegka); in the representatives of the middle intermediate somatotype only 17.5% of the indicators are symmetrically included in the same sonographic indexes of the kidneys (among which only 22.2% belong to highly genetically determined indicators - longitudinal dimensions and diameters of the body), and 82.5% of anthropo-somatotypological indicators have manifestations of asymmetry (among which 56.5% belong to highly genetically determined indicators - longitudinal dimensions, body diameters, pelvic sizes, width of distal epiphyses of long limb tubular bones, cephalometric indices, ectomorphic somatotype component by Carter-Heath and bone components of body weight by Matiegka).

Thus, the concept of anatomical, physiological and functional asymmetry between the kidneys is of interest to researchers. Bilateral kidney sizes is an important parameter for the clinical evaluation of patients with diabetes, renal artery stenosis, chronic renal failure, for the selection of candidates for kidney transplantation. Kidney sizes facilitates the differentiation of chronic and acute renal failure, if necessary, to decide whether kidney biopsy should be performed or not. Given the above, it is important to have exact standard size standards for each kidney separately.

Conclusions

1. In practically healthy men of different somatotypes the level of asymmetry of entering to the models sonographic sizes of the kidneys anthropometric and somatotypological indicators is: among representatives of mesomorphic somatotype - 84.1% (among which 50.0% belong to highly genetically determined indicators), in representatives of ecto-mesomorphic somatotype - 86.0% (among which 46.5% belong to highly genetically determined indices), in the representatives of the endo-mesomorphic somatotype - 88.1% (among which 51.4% belong to a highly genetically determined performances).

2. In practically healthy women of different somatotypes the level of asymmetry of entering to the models sonographic sizes of the kidneys body structure and body sizes is: in the representatives of the mesomorphic somatotype 82.0% (among which 51.2% belong to highly genetically determined indices), in the representatives of the ectomorphic somatotype - 89.0% of which 58.0% belong to highly genetically determined indicators), in the representatives of the endo-mesomorphic somatotype - 83.3% (among which 50.0% belong to highly genetically determined indicators), in representatives of middle intermediate somatotype - 82.5% (among which 56.5% belong to highly genetically determined indicators).

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ПРОЯВИ АСИМЕТРІЇ І КОРЕЛЯЦІЇ СОНОГРАФІЧНИХ ПАРАМЕТРІВ НИРОК ІЗ КОНСТИТУЦІОНАЛЬНИМИ ПАРАМЕТРАМИ ТІЛА ПРАКТИЧНО ЗДОРОВИХ ЧОЛОВІКІВ І ЖІНОК РІЗНИХ СОМАТОТИПІВ

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Проблема асиметрії є однією з фундаментальних в сучасній біології, теоретичній та клінічній медицині, вона має глибокі еволюційні корені. Аналіз літератури свідчить про те, що висвітлення різних аспектів морфо-функціональної асиметрії нирок до цього часу не завжди однозначне, а іноді і суперечливе. Мета роботи - встановити прояви асиметрії входження до регресійних моделей сонографічних розмірів нирок антропометричних і соматотипологічних параметрів тіла у практично здорових жінок і чоловіків різних соматотипів. У рамках договору про наукове співробітництво із бази даних науково-дослідного центру Вінницького національного медичного університету ім. М. І. Пирогова взяті первинні сонографічні параметри і антропометричні та соматотипологічні показники 121 практично здорової жінки та 97 практично здорових чоловіків першого зрілого віку (відповідно віком від 21 до 35 років та від 22 до 35 років), які у третьому поколінні проживають на території Подільського регіону України. Для побудови регресійних моделей індивідуальних сонографічних розмірів нирок в залежності від особливостей антропо-соматотипологічних параметрів тіла використовували ліцензійний пакет "Statistica 6.1". Для аналізу асиметрії входження до регресійних моделей сонографічних розмірів нирок антропо-соматотипологічних показників враховували усі побудовані достовірні моделі, а не лише моделі з коефіцієнтом детермінації більшим 0.6. Також при аналізі антропометричні і соматотипологічні показники відносили або до високо генетично детермінованих (поздовжні розміри тіла, кефалометричні показники, ширина дистальних епіфізів довгих трубчастих кісток кінцівок, діаметри тулуба, розміри таза, ектоморфний компонент соматотипу, кістковий компонент маси тіла), або до низько генетично детермінованих (маса, площа поверхні тіла, обхватні розміри тіла, показники товщини шкірно-жирових складок, ендоморфний та мезоморфний компоненти соматотипу, м'язовий та жировий компоненти маси тіла). У чоловіків різних соматотипів при аналізі асиметрії входження до моделей сонографічних розмірів нирок антропометричних і соматотипологічних показників встановлено: у представників мезоморфного соматотипу - 84,1% (серед яких 50,0% відносяться до високо генетично детермінованих показників), у представників екто-мезоморфного соматотипу - 86,0% (серед яких 46,5% відносяться до високо генетично детермінованих показників), у представників ендо-мезоморфного соматотипу - 88,1% (серед яких 51,4% відносяться до високо генетично детермінованих показників). У жінок різних соматотипів при аналізі асиметрії входження до моделей сонографічних розмірів нирок антропометричних і соматотипологічних показників встановлено: у представниць мезоморфного соматотипу - 82,0% (серед яких 51,2% відносяться до високо генетично детермінованих показників), у представниць ектоморфного соматотипу - 89,0% (серед яких 58,0% відносяться до високо генетично детермінованих показників), у представниць ендо-мезоморфного соматотипу - 83,3% (серед яких 50,0% відносяться до високо генетично детермінованих показників), у представниць середнього проміжного соматотипу - 82,5% (серед яких 56,5% відносяться до високо генетично детермінованих показників).

Ключові слова: асиметрія, регресійний аналіз, сонографічні параметри нирок, антропометрія, соматотип, практично здорові жінки та чоловіки.

ПРОЯВЛЕНИЯ АСИММЕТРИИ И КОРРЕЛЯЦИИ СОНОГРАФИЧЕСКИХ ПАРАМЕТРОВ ПОЧЕК С КОНСТИТУЦИОНАЛЬНЫМИ ПАРАМЕТРАМИ ТЕЛА ПРАКТИЧЕСКИ ЗДОРОВЫХ МУЖЧИН И ЖЕНЩИН РАЗНЫХ СОМАТОТИПОВ

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Проблема асимметрии является одной из фундаментальных в современной биологии, теоретической и клинической медицине, она имеет глубокие эволюционные корни. Анализ литературы свидетельствует о том, что освещение различных аспектов морфо-функциональной асимметрии почек до сих пор не всегда однозначно, а иногда и противоречиво. Цель работы - установить проявления асимметрии входжение в регрессионные модели сонографических размеров почек антропометрических и соматотипологических параметров тела у практически здоровых женщин и мужчин разных соматотипов. В рамках договора о научном сотрудничестве с базы данных научно-исследовательского центра Винницкого национального медицинского университета им. Н. И. Пирогова взяты первичные сонографические параметры и антропометрические и соматотипологические показатели 121 практически здоровой женщины и 97 практически здоровых мужчин первого зрелого возраста (соответственно в возрасте от 21 до 35 лет и от 22 до 35 лет), в третьем поколении

проживающих на территории Подольского региона Украины. Для построения регрессионных моделей индивидуальных сонографических размеров почек в зависимости от особенностей антропо-соматотипологических параметров тела использовали лицензионный пакет "Statistica 6.1". Для анализа асимметрии вхождения к регрессионным моделям сонографических размеров почек антропо-соматотипологических показателей учитывали все построенные достоверные модели, а не только модели с коэффициентом детерминации большим 0.6. Также при анализе антропометрические и соматотипологические показатели относили или к высоко генетически детерминированным (продольные размеры тела, кефалометрические показатели, ширина дистальных эпифизов длинных трубчатых костей конечностей, диаметры туловища, размеры таза, эктоморфный компонент соматотипа, костный компонент массы тела), или к низко генетически детерминированным (масса, площадь поверхности тела, обхватные размеры тела, показатели толщины кожно-жировых складок, эндоморфный и мезоморфный компоненты соматотипа, мышечный и жировой компоненты массы тела). У мужчин разных соматотипов при анализе асимметрии вхождения в модели сонографических размеров почек антропометрических и соматотипологических показателей установлено: у представителей мезоморфного соматотипа - 84,1% (среди которых 50,0% относятся к высоко генетически детерминированным показателям), у представителей экто-мезоморфного соматотипа - 86,0% (среди которых 46,5% относятся к высоко генетически детерминированным показателям), у представителей эндо-мезоморфного соматотипа - 88,1% (среди которых 51,4% относятся к высоко генетически детерминированным показателям). У женщин разных соматотипов при анализе асимметрии вхождения в модели сонографических размеров почек антропометрических и соматотипологических показателей установлено: у представительниц мезоморфного соматотипа - 82,0% (среди которых 51,2% относятся к высоко генетически детерминированным показателям), у представительниц эктоморфного соматотипа - 89,0% (среди которых 58,0% относятся к высоко генетически детерминированным показателям), у представительниц эндо-мезоморфного соматотипа - 83,3% (среди которых 50,0% относятся к высоко генетически детерминированным показателям), у представительниц среднего промежуточного соматотипа - 82,5% (среди которых 56,5% относятся к высоко генетически детерминированным показателям).

Ключевые слова: асимметрия, регрессионный анализ, сонографические параметры почек, антропометрия, соматотип, практически здоровые женщины и мужчины.