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SOMATO TYPOLOGICAL FEATURES OF WOMEN IN THE KYRGYZ POPULATION

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ABSTRACT
Introduction. It should be considered that the body constitution which is widely used in the preventive and clinical medicine, leaves an imprint on the body mass index. The objective of this work is to study the features of body mass index and fat body mass in females of different constitutional and age groups.
Materials and Methods. Using the method of complex anthropometry and bioimpedancometry ("Medass"), we have also studied the physical status of 580 ethnic Kyrgyz women living in Osh, Kyrgyzstan and its surroundings. Statistical data processing included the calculation of arithmetic mean and error, as well as the minimum and maximum of each indicator (variation amplitude). The significance of difference was assessed by Student's t-test.
Results. The body length and weight and, accordingly, the body mass index, significantly depend on the type of body constitution. The absolute fat mass is also unequal in women of different constitutional groups. The minimum and maximum of the absolute and percentage fat mass in women of the period of adulthood II with different body constitutions are, in general, more than in juvenile period.
Conclusion. The obtained results can be used to develop measures aimed at the timely detection of overweight and obesity as well as for the implementation of measures to prevent alimentary-related diseases in juvenile and adulthood period. Somatometric assessment of the physical development can be used in the dynamic monitoring of health status in organized groups: in educational institutions, youth sports schools, enterprises.
Keywords. women, body mass index, fat mass, body constitution

The current stage in the development of medical science is characterized by a growing interest in the problem of the constitutional typology of man. The relevance of using the constitutional-typological approach in a comprehensive study of the body is scientifically based and in demand by time. The somatic type, which is formed during the implementation of the hereditary program in a specific environment, reflects the level and harmony of the physical development of both the individual and the population.

In modern literature, there is large amount of information about the dependence of the morphological and functional characteristics of individual organs and systems of the

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human body on the types of body physique. However, in practice, to date, the features of individual anatomical variability of organs and systems are not always compared with the constitutional features of the subjects.

Constitutional anatomy and medical anthropology, revealing the forms and factors of the organism's variability, work closely with clinical medicine. Constitutional issues are in the sphere of interests of these sciences, based on the constitutional-anatomical approach. The feasibility of conducting research for clinical purposes is due to the repeatedly proven fact of a constitutional predisposition to the development of a number of diseases, the uneven effectiveness of the treatment of a number of nosological forms with different physique features.

Over the past few decades, a significant number of works have appeared that study the variability of the physical development of individuals to a greater extent from the position of morphological and functional features, which, apparently, is associated with such a phenomenon in the population as acceleration and retardation. However, the works devoted to the study of the morphological and functional characteristics of young people during the "post-acceleration" period and the metabolic manifestations that provide these changes are practically absent.

The most important issue of constitutional anatomy and physiology is the study of the physical development of people of various territorial groups, on the basis of which standards for the physical development of various populations are compiled. It should be noted that the standards being developed require periodic updating in connection with the process of acceleration of human somatic development. This emphasizes the need for periodic development of age-gender regional standards and norms of physical development, various geographic and economic regions.

Constitutional features determine the biological processes; in case of leptosomatic (asthenic) body type, the processes of growth and development are often slowed down and stretched in time, whereas in case of hypersthenic body type, they are accelerated [1-5].

It should be considered that the body constitution which is widely used in the preventive and clinical medicine, leaves an imprint on the body mass index [6-10].

A body mass index of less than 18.5 indicates chronic energy deficiency, while more than 25 shows excess body weight, and more than 30, demonstrates obesity. Nevertheless, body mass index assessment without regard to the person's body constitution as well as the application of the same standard to different somatotypes is methodologically incorrect. For example, asthenic (thin and, small) or pyknic somatotypes (constitutionally characterized by excessive fat deposition) should be considered differently [11-14].

For instance, in the Hungarian population more than half of the population above the age of 15 years is overweight, while every fifth person is obese (Maximova, O'Loughlin, Paradis, Hanley & Lynch, 2009). In one cross-sectional study, of the 123 adolescents 21.65% were found to be overweight and 6.37% obese by the international BMI criteria.

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According to one study, the average height of the juvenile girls in Hungary was 156.95±10.44 cm; weight – 43.52±8.64 kg; body mass index – 17.51±2.04 kg/m2; body fat percentage – 23.50±4.39% [16]. Obesity, however, was defined based on BMI, which is an imperfect measure of body fat. It is not clear whether body fatness is a stronger predictor of obesity-related health outcomes or BMI (Freedman, Katzmarzyk, Dietz, Srinivasan, & Berenson, 2009). BMI is highly correlated with the body fat at every level. Obesity in adulthood is an increasing problem worldwide that could be traced back to adiposity and obesity in childhood and adolescence (Saar, 2008). Adiposity in childhood persists in the adolescents, and permanent obesity often leads to many diseases later on like cardiovascular, respiratory, musculoskeletal disorders and a variety of physiological and psychological problems (Marshall, Sarkin, Sallis & McKenzie, 1998; Tremblay et al., 2011). Obesity will cause disregulation of adipocytokines (TNF-α, IL-6, adiponectin) early in life (Nemet et al., 2003). These agents are important in carbohydrate and fat metabolism of fat cells and by this inducing atherosclerosis and type 2 diabetes. This fact is mirrored in Conrad's MIX, since it is showing the ratio of muscle and fat in the body (Conrad, 1963).

According to the literature, the individual variability of the human body is understood as the change in physiological, biochemical, and morphological characteristics that determine the diversity of the morphophysiological organization of closely related individuals.

At the same time, it is fair to say that there is a need to accumulate new data, create a data bank on the anatomical and anthropological constitutional variability of all organs and systems of the body since the available materials are incomplete and fragmented. Several works outline only trends, but they are not backed by modern evidence-based mathematical apparatus and many results are difficult to compare.

There are some articles on the internet where body mass index and absolute fat mass of Kyrgyz women were discussed but we have not found any report about their body constitution which is an important aspect when considering weight. There has been only one study about anthropometric features of ethnic Kyrgyz of different age groups, but it included data about growth-weighted indexes of men of youthful and mature age and not comprised any considered information about women [13].

Another study we found, was dedicated to the prevalence of childhood and adolescent overweight and obesity in Asian countries but this research has no information about the somatotype of the considered groups [15].

That is why, we initiated research which includes groups of the body constitution in Kyrgyz women.

The objective of this work is to study the features of body mass index and fat body mass in females of different constitutional and age groups.

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Materials and Methods

This was retrospective study where all actual research material was collected in the period from 2009 to 2018. The complex of anatomical and anthropometric examinations was in accordance with generally accepted ethical standards. It was approved by the decision of the local ethics committee of the Institute of Medical Problems of the Southern Branch of the National Academy of Sciences of the Kyrgyz Republic (12.10.16, protocol No. 4). All subjects signed an Informed Consent Form to participate in anthropometric studies. The sampling was based on the principle of voluntary participation.

We used the generally accepted traditional scheme of age-related periodization of onto-genesis.

Using the method of complex anthropometry and bioimpedancemetry (“Medass”), we have also studied the physical status of 580 ethnic Kyrgyz women living in Osh, Kyrgyzstan and its surroundings. Therefore, in the study were included women in the juvenile, adulthood I, and adulthood II periods. The subjects did not include cases with diseases affecting the physical status (alimentary-dependent pathology, degenerative-dystrophic diseases, etc.).

The method of bioimpedancemetry is based on measuring the bioelectric resistance of body tissues (“impedance” – resistance, “bio-impedance” – resistance of biological tissues) with a special device – a bio-impedance analyzer.

In this case, an integral assessment of body composition is carried out using a several-component model: analysis of fat mass and total content other components in the body. In particular, the content of adipose tissue and active cell mass, indicators of metabolic rate and the ratio of extracellular to intracellular fluid are monitored. Based on the obtained parameters, conclusions are drawn about normal or impaired tissue hydration, lipid, and water-salt metabolism.

Thus, the bio-impedance analyzer allows to determine the biological age of the person, and at the same time monitor the results throughout the entire period of work.

Bioimpedansometry is considered accurate for measuring individuals or for tracking an individual’s body composition over a period of time.

Cell tissue impedance can be modeled as a resistor (representing the extracellular path-way) in parallel with a resistor and capacitor in series (representing the intracellular pathway).

This pattern leads to a change in impedance compared to the frequency used in the measurement. The impedance measurement is usually measured from the wrist to the contralateral ankle and uses either two or four electrodes. A small current of the order of 1–10 μA passes between two electrodes, and the voltage is measured between the same (for a two-electrode configuration) or between two other electrodes [8].

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Using a four-electrode technique on the arms and legs, an electric field is created, and the alternating current impedance is measured, which consists of the resistance (Rx) and reactance (Xc), as well as the phase shift of the alternating current.

The stature was measured by a height meter. When measuring stature, the subjects stood with their backs to the vertical wall stand. The regulator was lowered until it touched the head. The body mass index was determined by dividing the weight in grams by the height in centimeters. Weight was measured by using weights.

The analysis of the body constitution was carried out according to the scheme of I. B. Galant, B. A. Nikityuk and V. P. Chetsov. Statistical data processing included the calculation of arithmetic mean and error, as well as the minimum and maximum of each indicator (variation amplitude). The significance of difference was assessed by Student's t-test.

The statistical significance of the research results is a measure of confidence in its "fidelity" ("representativeness of the sample"). More precisely, the p-level is an indicator inversely proportional to the reliability of the result. A higher p level corresponds to a lower confidence level found in the sample results. P-level = 0.05 (i.e., 1/20) shows that there is a 5% probability that the relationship between the variables found in the sample is just an accident in this sample. In other words, if this dependence is in the general data set and similar experiments were carried out many times, then in approximately one of twenty repetitions of the study, one can expect the same or stronger dependence between the studied variables. In many studies, a p-level of 0.05 is considered the "acceptable level" of error. During statistical data processing, methodological guidelines were used on the main methodological techniques of statistical analysis in biological and medical research.

Results

According to our data, the leptosomatic group of body constitution was determined in 20%, while the mesosomatic group was noted in 32%, the megalosomatic group was recorded in 33% and an indefinite group was established in 15% among the studied women. At the same time, during the transition from juvenile period to adulthood I period, and then to the adulthood II period, no fundamental changes in the constitutional features were observed, which corresponds to the concept of B. A. Nikityuk and V. P. Chetsov on the modification nature of these changes.

The body length and weight, and, accordingly, the body mass index significantly depend on the type of body constitution (Table 1).

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Table 1. Weight-for-height and the body mass index in the juvenile, adulthood I, and adulthood II periods in females of different constitutional groups (X + Sx; min-max).

Period and age	**Constitutional groups**			
	Leptosomatic	**Mesosomatic**	**Megalosomatic**	**Indefinite**
Body length (cm)				
Juvenile	158,5±0,6 142,0-166,2	161,7±0,5 149,0-165,9	167,1±0,6 154,8-189,0	173,5±0,5 160,3-175,9
Adulthood I	161,9±0,6 142,7-165,8	161,9±0,3 154,5-165,4	168,5±0,6 156,4-190,5	167,5±0,5 156,3-170,9
Adulthood II	154,6±0,5 143,2-164,5	160,3±0,3 152,1-166,3	165,4±0,9 154,2-192,4	167,9±0,4 156,5-172,5
Body weight (kg)				
Juvenile	44,5±0,5 36,4-54,5	56,4±0,4 42,6-64,9	70,9±0,6 56,4-92,3	71,6±0,6 56,5-70,2
Adulthood I	45,2±0,5 39,9-56,5	68,4±0,4 54,3-82,3	77,5±0,6 62,3-98,6	72,3±0,6 60,4-75,1
Adulthood II	46,2±0,4 39,9-57,4	74,0±0,6 55,3-84,4	85,1±0,6 68,4-99,6	86,0±0,6 68,0-94,2
Body mass index				
Juvenile	17,1±0,2 12,2-24,5	21,5±0,3 14,2-28,1	25,3±0,2 20,2-30,4	23,8±0,3 18,2-27,4
Adulthood I	17,6±0,3 15,2-24,4	26,2±0,2 20,2-29,5	24,9±0,2 20,7-30,8	25,8±0,3 21,4-31,4
Adulthood II	18,7±0,3 16,8-24,5	28,8±0,2 23,4-32,4	31,2±0,2 24,3-38,1	30,5±0,2 23,2-33,4

In females of the leptosomatic group in adulthood period, the body length was the same as that of the mesosomatic group which is, less than in the megalosomatic and indefinite constitutional groups (1.1 times; $p < 0.05$).

The minimum and maximum body lengths in women with leptosomatic body constitution of the considered age were slightly less than those in women of the megalosomatic and indefinite constitutional groups.

We also revealed a tendency according to which the body length slightly increases and then decreases during the transition from juvenile period to adulthood I period. An age-

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related decreasing of the body length in the adulthood II period was probably associated with a flattening of the arches of the foot, a decrease in the thickness of the intervertebral discs and an increase in the sagittal curvature of the spine, which are proven anatomical facts.

In leptosomatic juvenile period, the body weight was less than in mesosomatic (1.3 times; $p < 0.05$), megalosomatic, and indefinite constitutional groups (1.6 times; $p < 0.05$). In the adulthood I, the body weight in women of the leptosomatic group was less than in the mesosomatic (1.5 times; $p < 0.05$), megalosomatic (1.7 times; $p < 0.05$), and indefinite groups (1.6 times; $p < 0.05$). In the adulthood II, the body weight in the women of the leptosomatic group compared with the women of the mesosomatic group, was less by 1.6 times ($p < 0.05$) whereas it was less by 1.8 times in the megalosomatic group ($p < 0.05$), and by 1.9 times in the indefinite group ($p < 0.05$).

The minimum and maximum body weights in leptosomatic women of the age groups considered by us were less than in megalosomatic and indefinite groups of body constitution.

The standard value of body mass index also depends on the body constitution (see Table 1). Body mass index in the leptosomatic females in the juvenile period was less than that in the mesosomatic (1.2 times; $p < 0.05$), megalosomatic (1.5 times; $p < 0.05$), and indefinite (1.4 times; $p < 0.05$) groups. In the adulthood I, the body mass index in the women of the leptosomatic group was less than that in the mesosomatic (1.5 times; $p < 0.05$), megalosomatic (1.4 times; $p < 0.05$), and indefinite (1.5 times; $p < 0.05$) groups. In the adulthood II, the body mass index in women of the leptosomatic group compared with the women of the mesosomatic group, was less by 1.6 times ($p < 0.05$) whereas it was less by 1.7 times in the megalosomatic and indefinite groups ($p < 0.05$).

Body mass index and body weight, regardless of the constitutional group, increase by adulthood II, which should be also considered when assessing standards.

Minimum and maximum values of body mass index in leptosomatic women of all examined age groups were less than those in other body constitutions.

The absolute fat mass is also unequal in women of different constitutional groups (Table 2).

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Table 2. The absolute fat mass in the juvenile, adulthood I, and adulthood II periods in females of different body constitutions (X + Sx; min-max; kg and %).

Age period	**Constitutional groups**			
	Leptosomatic	**Mesosomatic**	**Megalosomatic**	**Indefinite**
Juvenile	8,5±0,2 5,5-11,8	17,8±0,4 12,4-32,0	26, 8±0,4 18,4-35,5	17,6±0,8 12,2-30,0
Adulthood I	8,7±0,2 5,7-12,9	19,4±0,4 11,7-33,5	28,3±0,4 16,0-36,0	20,6±0,3 22,1-30,0
Adulthood II	9,7±0,1 8,7-13,3	21,2±0,4 13,7-34,5	34,1±0,5 18,2-49,0	25,4±0,8 20,0-36,4

Considering the absolute fat mass in the juvenile period of the leptosomatic body constitution, its content in the juvenile period of the mesosomatic and indefinite body constitutions prevails by 2.1 times ($p < 0.05$), whereas in the megalosomatic body constitution, it does – by 3.2 times ($p < 0.05$). In women of the leptosomatic group of the adulthood I, the absolute fat mass was 2.3 times less than that in women of the mesosomatic group ($p < 0.05$), while in megalosomatic and indefinite constitutions, – it was less by 3.3 ($p < 0.05$) and 2.4 ($p < 0.05$) times, respectively. In women of the leptosomatic constitution in the adulthood II, the absolute fat mass was 2.2 times ($p < 0.05$) less than that in women of the mesosomatic, while in the megalosomatic and indefinite constitutions, it was less by 3.6 ($p < 0.05$), 2.7 ($p < 0.05$) times.

We analyzed the features of the absolute fat mass in the age aspect. The absolute value of the index in the leptosomatic women of adulthood I has not changed compared with the juvenile period, whereas in adulthood II, it has increased by 1.1 times ($p < 0.05$). The absolute fat mass in females of the mesosomatic constitution in the adulthood I, was 1.1 times higher ($p < 0.05$) than it was in juvenile period, while it was 1.2 times ($p < 0,05$) higher in the adulthood II. The absolute fat mass in women of the megalosomatic body constitution in the adulthood I and II, was 1.1 and 1.3 ($p < 0,05$) times higher ($p > 0.05$) than it was in juvenile period, respectively. The absolute fat mass in women of the indefinite body constitution in the adulthood I and II, was 1.2 and 1.5 ($p < 0,05$) times higher ($p < 0.05$) than it was in juvenile period, respectively.

The minimum and maximum values of the absolute fat mass and its percentage in women of the adulthood II of different body constitutions are, in general, more than in juvenile period.

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Discussion

Consequently, our hypothesis of the study is confirmed. The body length and weight and, accordingly, the body mass index, significantly depend on the type of body constitution. The absolute fat mass is also unequal in women of different constitutional groups. The minimum and maximum of the absolute and percentage fat mass in women of the period of adulthood II with different body constitutions are, in general, more than in juvenile period.

Data obtained during somatometry and somatotyping at different age periods indicate that the process of body formation occurs not only during juvenile period, but also continues in adulthood [13].

It must be considered that women performed and are performing diverse educational, reproductive, social, industrial, and social functions, therefore, the health of the nation is largely determined by the health of women. Most authors believe that at the age of 17-21 years, the process of growth and formation of the body basically ends, and all the main proportional signs of the body reach their final value. At present, somatometric studies focus on regional differences in anthropometric indicators on a regional and national scale in order to identify geographically and environmentally determined, as well as ethnic features of the body structure and physical development of people.

Variants of the female constitution are described by such anthropological indicators as body length, degree of fat deposition, body proportions, and are divided into types that differ not only in morphological, psychophysiological characteristics, but also in chronobiological organization and variability of the functional state of the body, due to the constitutional level of the organism’s reactivity.

The accumulation of knowledge about the patterns of development of the female body is one of the urgent tasks of modern preventive medicine.

In connection with the foregoing, particular interest presents the comprehensive study of the anatomical and anthropological indicators and variability of body composition [13].

Advantages of the study included inexpensiveness. In addition, in the medical context the obtained results can be used to develop measures aimed at the timely detection of over-weight and obesity as well as for the implementation of measures to prevent alimentary-related diseases in juvenile and adulthood period; somatometric assessment of the physical development can be used in the dynamic monitoring of health status in organized groups: in educational institutions, youth sports schools, in enterprises; the assessment of the individual-typological features of the physical development of individuals can be used in the development of the regional biomedical programs aimed at strengthening and preserving the health of the younger generation; the above data can be used for screenings, too.

Disadvantages of the study: the localness of the observed phenomena and the associated lower chance of a sweeping generalization of the results.

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Conclusion

In this article, we aimed to study features of body mass index and fat body mass in females of different constitutional and age groups. As a result of the study, constitutional and age peculiarities of body length, body weight, body mass index, and the absolute fat mass were revealed, the knowledge of which is important for practical medicine. The body length and weight and, accordingly, the body mass index, significantly depend on the type of body constitution. The absolute fat mass is also unequal in women of different constitutional groups. The minimum and maximum of the absolute and percentage fat mass in women of the period of adulthood II with different body constitutions are, in general, more than in juvenile period. The obtained results can be used to develop measures aimed at the timely detection of overweight and obesity as well as for the implementation of measures to prevent alimentary-related diseases in juvenile and adulthood period. Somatometric assessment of the physical development can be used in the dynamic monitoring of health status in organized groups: in educational institutions, youth sports schools, in enterprises. The assessment of the individual-typological features of the physical development of individuals can be used in the development of the regional biomedical programs aimed at strengthening and preserving the health of the younger generation.

Declarations:

The authors declare that they have no conflicts of interest, that the work has been approved by the ethics committee responsible in the workplace, and do not declare means of financing of the work carried out.

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