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GIRTH BODY DIMENSIONS IN UKRAINIAN MEN AND WOMEN WITH MULTIPLE SCLEROSISИ

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Annotation. *Multiple sclerosis is a chronic autoimmune disease of the central nervous system, accompanied by a wide range of neurological disorders. Somatic characteristics of patients, in particular anthropometric indicators, can play a role in the clinical course of the disease and its prognosis. The study of body composition in patients of different sexes allows us to identify potential gender features that can be useful for a personalized approach to diagnosis and treatment. The relevance of the study is due to the need for a comprehensive understanding of the relationships between somatotypological parameters and neurodegenerative processes. The aim of the study is to establish the characteristics and gender differences in body circumference dimensions in young Ukrainian men and women with multiple sclerosis with varying degrees of disability. Body circumference dimensions were determined in 35 Ukrainian men and 59 young women with multiple sclerosis with mild, moderate and moderately severe impairments. The initial body circumference dimensions of 82 practically healthy Ukrainian men and 101 women of similar age were taken from the data bank of the National Pirogov Memorial Medical University, Vinnytsya Research Center. Statistical analysis was performed in the "Statistica 6.0" license package using non-parametric evaluation methods. When comparing body circumference dimensions between practically healthy men or women and those with multiple sclerosis, numerous significant or trends in differences were established: in all groups of sick men and women – larger values of the circumferences of the forearm and lower leg and foot; in all groups of male patients – larger values of the upper arm circumference; in all groups of patients and women – larger values of the hand, waist and chest circumferences on exhalation; in most groups of male and female patients – larger values of other girth sizes of the upper, lower limbs and trunk. Between male or female patients with multiple sclerosis, numerous significant or trends of differences were established only for the girths of the upper limb and trunk in men (smaller values in patients with moderate disorders compared to mild and moderately severe disorders). Between male and female patients with multiple sclerosis, pronounced manifestations of sexual dimorphism of all girth sizes of the upper limbs and trunk were established (significantly larger values in male patients of the general group, with mild and moderately severe disorders).*

Keywords: *nervous diseases, multiple sclerosis, girth dimensions of the body, practically healthy and sick men and women, sexual differences.*

Introduction

Multiple sclerosis is a chronic, immune-mediated disease of the central nervous system (CNS) characterized by demyelination, inflammation, and neurodegeneration. It manifests with a wide spectrum of neurological symptoms that may include impairment of motor functions, vision, sensation, coordination, and cognitive abilities. Current understanding of the pathogenesis of multiple sclerosis is based on a complex interaction of genetic and environmental factors that trigger an autoimmune response directed against the myelin structures of the CNS. It has been established that the activation of T and B lymphocytes, impaired blood-brain barrier function, and the involvement of microglia play a key role in the onset and progression of the disease [2]. In particular, recent studies indicate that even in the early stages of the disease, irreversible neurodegeneration processes occur, which lead to persistent neurological deficits [8].

Diagnosis of multiple sclerosis remains challenging due to the heterogeneity of clinical manifestations and requires the use of modern neuroimaging techniques, such as MRI, as well as consideration of clinical, laboratory, and neurophysiological criteria [5]. An important step in establishing the diagnosis is the exclusion of other pathologies that can mimic multiple sclerosis and confirmation of the dissemination of the process in space and time. Currently, approaches to early diagnosis and stratification of the risk of disease progression based on biomarkers, including cerebrospinal fluid and immunological profiles, are actively developing [2].

Multiple sclerosis has a significant negative impact not only on the physical condition of patients, but also on their psychoemotional well-being and social adaptation. According to studies, up to 50 % of patients with multiple sclerosis suffer from depressive disorders, which can have both a direct neurobiological mechanism and be a reaction to the loss of functional independence [15]. Comorbidity, including anxiety and affective disorders, exacerbates the clinical picture, complicates treatment, and impairs quality of life [4]. It has also been established that patients with multiple sclerosis experience significant socio-emotional isolation, face difficulties in maintaining interpersonal relationships, and decrease independence, which further reduces the overall level of life satisfaction [10]. The quality of life of individuals with multiple sclerosis largely depends on the degree of disability, the frequency of relapses, the rate of disease progression, and the availability of treatment and social

support. Evidence suggests that even with adequate drug control of the disease, residual symptoms and psychological consequences of the disease significantly limit patients' daily activities [16]. It has been established that factors related to the duration of the disease, age of onset, and socioeconomic status have a significant impact on the level of quality of life of such patients [4]. Therefore, a comprehensive approach to assessing the functional status of patients with multiple sclerosis should consider not only neurological status but also psychosocial aspects [10].

Multiple sclerosis is also associated with a high economic burden for both patients and healthcare systems. In the United States, the total annual costs associated with multiple sclerosis are estimated at $85.4 billion, of which about 63 % are direct costs for healthcare and medications [3]. A significant portion of the costs are for the use of expensive disease-modifying drugs, as well as outpatient and inpatient treatment, rehabilitation, psychotherapeutic support and assistive devices [14]. In addition, indirect costs due to loss of work capacity, early retirement and the need for care for the sick are also significant [3]. At the global level, the economic burden of multiple sclerosis reflects not only the costs of treatment, but also the social consequences associated with disability and reduced labor productivity [21].

In this context, it is relevant to study the somatic parameters of individuals suffering from multiple sclerosis, in particular body composition indicators, which may be associated with both the characteristics of the course of the disease and its prognosis. Changes in weight-height characteristics and body circumferences may reflect not only the physical consequences of prolonged immobilization or a side effect of pharmacotherapy, but also more profound metabolic and neuroendocrine changes. Gender differences in anthropometric characteristics of patients with multiple sclerosis still remain poorly studied, despite the potential significance of these data for individualizing treatment and rehabilitation approaches. Therefore, an in-depth study of body circumference measurements among Ukrainian men and women with multiple sclerosis may provide new important information about the somatotypological aspects of this disease and their relationship with clinical and social consequences [19].

The purpose of the study – determination of characteristics and gender differences in body girth measurements in young Ukrainian men and women with multiple sclerosis with different degrees of disability.

Materials and methods

On the basis of the Department of Nervous Diseases of the National Pirogov Memorial Medical University, Vinnytsya and the "Salyutem" Medical Center (Vinnytsya), 35 Ukrainian men and 59 young women (25-44 years old according to the WHO age periodization, 2015) patients with multiple sclerosis were determined by the girth measurements of the body according to the schemes of V. V. Bunak modified by P. P. Shaparenko [18]. Namely: shoulder girths in a tense state (OBPL1), shoulder in a relaxed state (OBPL2), upper forearm (OBPR1), lower forearm (OBPR2), hand (OBK), thigh (OBB), hips (OBBB), upper leg (OBG1), lower leg (OBG2), foot (OBS), neck (OBSH), waist (OBT), chest on inspiration (OBGK1), chest on expiration (OBGK2) and chest in a calm state (OBGK3).

Committee on Bioethics of National Pirogov Memorial Medical University, Vinnytsya (protocol № 10 from 10.12.2021) found that the studies do not contradict the basic bioethical standards of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant WHO regulations and laws of Ukraine.

The diagnosis of multiple sclerosis was established according to the McDonald criteria [22]. The degree of disability was assessed using the Expanded Disability Status Scale. The following distribution of patients was established: with mild impairments (EDSS 2.0-3.0) – 24 men and 26 women; with moderate impairments (EDSS 3.5-4.5) – 7 men and 24 women; with moderately severe impairments (EDSS 5.0-6.5) – 4 men and 9 women.

As a control, the initial body circumference measurements of 82 practically healthy Ukrainian men and 101 Ukrainian women of similar age were used, taken from the data bank of the National Pirogov Memorial Medical University, Vinnytsya Research Center.

The obtained results were processed in the licensed package «Statistica 6.0» using non-parametric evaluation methods. The averages for each feature and the standard square deviation were determined. The significance of the difference in values was determined using the Mann-Whitney U-test.

The study was conducted at the National Pirogov Memorial Medical University, *Vinnytsya "Constitutional features of body structure in people with multiple sclerosis and it's impact on the course of the disease", state registration No. 0121U114309.*

Results. Discussion

The results of determining and discrepant body dimensions in men and women with multiple sclerosis with mild, moderate, and moderately severe disorders are presented in Tables 1, 2, and 3.

When analyzing the differences in the *girth sizes of the upper limbs between practically healthy* men or women and those *with multiple sclerosis*, it was established (see Table 1): *in patients with multiple sclerosis, men or women in general, in patients with mild, moderate and moderately severe disorders*, significantly ($p<0.01-0.001$) greater values of the forearm girth in the lower part were found (respectively, in male patients by 22.59 % – 23.17 % – 14.85 % – 31.88 %, in female patients by 23.40 % – 21.46 % – 27.41 % – 18.49 %); *in male patients with multiple sclerosis* – in the general group of patients and in patients with mild and moderately severe disorders, significantly ($p<0.05-0.001$) larger or pronounced tendency ($p=0.058$) to larger values of shoulder girth in a tense state (by 10.51 % – 12.36 % – 19.75 %, respectively), forearm in the upper part (by 3.26 % – 5.20 % – 8.85 %,

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Table 1. Differences in the circumference sizes of the upper limbs in practically healthy and multiple sclerosis patients of Ukrainian men and women (M±σ).

Parameters and groups	Men				
	OBPL1 (cm)	OBPL2 (cm)	OBPR1 (cm)	OBPR2 (cm)	OBK (cm)
1. Practically healthy	30.17± 2.94	33.23± 2.84	27.33± 2.01	17.44± 1.24	21.39± 1.22
2. Patients in general	33.34± 4.74***	34.44± 4.88***	28.22± 3.01***	21.37± 2.77***	23.29± 2.38***
3. Patients with EDSS 2.0-3.0	33.90± 4.92***	35.06± 5.13***	28.75± 2.67***	21.48± 2.34***	23.67± 2.12***
4. Patients with EDSS 3.5-4.5	29.86± 3.29	30.79± 3.09	25.54± 3.35	20.03± 2.68	21.79± 3.11
5. Patients with EDSS 5.0-6.5	36.13± 2.56*	37.13± 2.32*	29.75± 1.94**	23.00± 4.78*	23.63± 1.93**
p1-2	**<0.01**	>0.05	**=0.058**	**<0.001**	**<0.001**
p1-3	**<0.01**	>0.05	**<0.01**	**<0.001**	**<0.001**
p1-4	>0.05	**<0.05**	**<0.05**	**<0.01**	>0.05
p1-5	**<0.01**	**<0.05**	**<0.05**	**<0.01**	**<0.05**
p3-4	**=0.056**	**<0.05**	**<0.05**	>0.05	**=0.059**
p3-5	>0.05	>0.05	>0.05	>0.05	>0.05
p4-5	**<0.05**	**<0.05**	**<0.05**	>0.05	>0.05
Parameters and groups	Women				
	OBPL1 (cm)	OBPL2 (cm)	OBPR1 (cm)	OBPR2 (cm)	OBK (cm)
1. Practically healthy	26.54± 2.88	27.96± 2.92	23.57± 1.98	15.47± 1.14	18.78± 1.20
2. Patients in general	28.90± 3.65	29.76± 3.63	24.25± 2.01	19.09± 2.13	20.85± 1.50
3. Patients with EDSS 2.0-3.0	28.33± 3.49	29.17± 3.42	23.98± 1.68	18.79± 2.25	20.79± 1.28
4. Patients with EDSS 3.5-4.5	29.71± 3.41	30.63± 3.45	24.79± 2.10	19.71± 1.95	21.15± 1.62
5. Patients with EDSS 5.0-6.5	28.38± 4.66	29.17± 4.60	23.56± 2.46	18.33± 2.02	20.24± 1.71
p1-2	**<0.001**	**<0.01**	**<0.05**	**<0.001**	**<0.001**
p1-3	**<0.05**	>0.05	>0.05	**<0.001**	**<0.001**
p1-4	**<0.001**	**<0.001**	**<0.05**	**<0.001**	**<0.001**
p1-5	>0.05	>0.05	>0.05	**<0.001**	**<0.01**
p3-4	**=0.079**	**=0.084**	>0.05	**=0.053**	>0.05
p3-5	>0.05	>0.05	>0.05	>0.05	>0.05
p4-5	>0.05	>0.05	>0.05	**=0.086**	>0.05

Notes: in this and the following tables, p – significance of differences in indicators between the corresponding groups of men or women; *, **, *** – significant differences (respectively <0.05, <0.01 or <0.001) of indicators between the corresponding groups of men and women (higher values are indicated).

Table 2. Differences in the circumference sizes of the lower extremities in practically healthy and multiple sclerosis patients of Ukrainian men and women (M±σ).

Parameters and groups	Men				
	OBB (cm)	OBBB (cm)	OBG1 (cm)	OBG2 (cm)	OBS (cm)
1. Practically healthy	53.25± 4.49	95.04± 6.39	36.43± 2.91	23.41± 1.87	24.96± 1.46
2. Patients in general	57.19± 7.31	102.3± 9.1	37.94± 3.74*	26.51± 2.31	27.11± 1.59***
3. Patients with EDSS 2.0-3.0	58.32± 7.22	103.1± 8.8	38.54± 3.55*	26.69± 2.28	27.21± 1.60***
4. Patients with EDSS 3.5-4.5	53.06± 7.93	96.50± 10.12	36.21± 4.08	25.14± 1.57	26.57± 1.90*
5. Patients with EDSS 5.0-6.5	57.63± 5.44	107.8± 4.1ttt	37.38± 4.27	27.88± 2.95	27.50± 0.82**
p1-2	**<0.01**	**<0.001**	**<0.05**	**<0.001**	**<0.001**
p1-3	**<0.001**	**<0.001**	**<0.01**	**<0.001**	**<0.001**
p1-4	>0.05	>0.05	>0.05	**<0.05**	**<0.05**
p1-5	**=0.085**	**<0.01**	>0.05	**<0.01**	**<0.01**
p3-4	>0.05	**=0.059**	>0.05	**=0.059**	>0.05
p3-5	>0.05	>0.05	>0.05	>0.05	>0.05
p4-5	>0.05	**=0.059**	>0.05	>0.05	>0.05
Parameters and groups	Women				
	OBB (cm)	OBBB (cm)	OBG1 (cm)	OBG2 (cm)	OBS (cm)
1. Practically healthy	53.26± 4.48	95.08± 6.95	34.85± 2.94	22.21± 1.61	22.79± 1.28
2. Patients in general	57.38± 5.69	100.1± 7.6	36.26± 3.54	26.67± 3.27	24.71± 1.42
3. Patients with EDSS 2.0-3.0	57.87± 5.25	99.94± 7.04	36.44± 3.75	26.94± 3.88	24.80± 1.61
4. Patients with EDSS 3.5-4.5	58.29± 5.34*	101.8± 7.3*	36.71± 3.00	26.58± 2.74	24.85± 1.30
5. Patients with EDSS 5.0-6.5	53.56± 6.84	96.00± 9.08	34.56± 4.10	26.11± 2.90	24.06± 1.07
p1-2	**<0.001**	**<0.001**	**<0.05**	**<0.001**	**<0.001**
p1-3	**<0.001**	**<0.01**	**=0.065**	**<0.001**	**<0.001**
p1-4	**<0.001**	**<0.001**	**<0.05**	**<0.001**	**<0.001**
p1-5	>0.05	>0.05	>0.05	**<0.001**	**<0.01**
p3-4	>0.05	>0.05	>0.05	>0.05	>0.05
p3-5	>0.05	>0.05	>0.05	>0.05	>0.05
p4-5	**=0.090**	**=0.097**	**=0.066**	>0.05	>0.05

Notes: ttt – trends of differences (respectively from 0.051 to 0.070) of indicators between the corresponding groups of men and women (higher values are indicated).

respectively) and hand (by 8.88 % – 10.66 % – 10.47 %, respectively), in patients with moderate disorders, significantly (p<0.05 in both cases) smaller values of shoulder girth in a relaxed state (by 7.34 %) and forearm in the upper part (by 6.55 %), as well as in patients with Moderately severe disorders had a significantly (p<0.05) higher value of shoulder girth in a relaxed state (by 11.74 %); *in female patients with multiple sclerosis* – in the general group of patients, in patients with mild, moderate and moderately severe disorders, significantly (p<0.01-0.001) higher values of hand circumference were established (by 11.02 % – 10.70 % – 12.62 % – 7.77 %, respectively); in the general group of patients and in patients with moderate disorders, significantly (p<0.05-0.001) higher values of shoulder circumference in a relaxed state (by 6.44 % and 9.55 %, respectively) and forearm in the upper part (by 2.89 % and 5.18 %, respectively); and also in the general group of patients, in patients with mild, moderate and moderately severe disorders, significantly (p<0.05-0.001) higher values of shoulder circumference in a tense state (respectively by 8.89 % – 6.74 % – 11.94 %).

When analyzing the differences in the *circumference sizes of the upper extremities between* men or women *with multiple sclerosis with different degrees of disability*, it was established (see Table 1): *in male patients* with moderate

Table 3. Differences in body circumference dimensions in practically healthy and multiple sclerosis patients of Ukrainian men and women (M±σ).

Parameters and groups	Men				
	OBSH (cm)	OBT (cm)	OBGK1 (cm)	OBGK2 (cm)	OBGK3 (cm)
1. Practically healthy	37.67± 1.92	79.48± 7.32	100.0± 6.0	93.18± 6.39	95.20± 6.57
2. Patients in general	38.74± 3.35***	87.99± 12.08***	103.7± 10.0***	101.7± 10.4***	100.9± 10.3***
3. Patients with EDSS 2.0-3.0	38.90± 3.03***	87.71± 12.04***	104.9± 9.5***	102.9± 9.8***	102.0± 9.9***
4. Patients with EDSS 3.5-4.5	36.50± 3.75*	83.43± 10.51	96.57± 10.58	94.29± 11.16	93.50± 10.75
5. Patients with EDSS 5.0-6.5	41.75± 2.22**	97.63± 12.13*	109.0± 7.1**	108.0± 7.0**	106.8± 6.6**
p1-2	>0.05	**<0.001**	**=0.063**	**<0.001**	**<0.01**
p1-3	**=0.097**	**<0.01**	**<0.05**	**<0.001**	**<0.01**
p1-4	**=0.075**	>0.05	>0.05	>0.05	>0.05
p1-5	**<0.01**	**<0.01**	**<0.05**	**<0.01**	**<0.01**
p3-4	**<0.05**	>0.05	**<0.05**	**<0.05**	**<0.05**
p3-5	**<0.05**	>0.05	>0.05	>0.05	>0.05
p4-5	**<0.05**	**=0.089**	**<0.05**	**<0.05**	**<0.05**
Parameters and groups	Women				
	OBSH (cm)	OBT (cm)	OBGK1 (cm)	OBGK2 (cm)	OBGK3 (cm)
1. Practically healthy	31.96± 1.45	68.98± 6.29	89.75± 5.88	82.68± 6.33	85.34± 6.20
2. Patients in general	33.15± 2.92	77.20± 9.89	92.60± 8.83	90.68± 8.92	89.70± 8.83
3. Patients with EDSS 2.0-3.0	32.83± 3.14	75.60± 9.93	91.88± 8.42	89.65± 8.51	88.33± 8.07
4. Patients with EDSS 3.5-4.5	33.38± 2.44	79.40± 9.59	94.56± 8.42	92.79± 8.42	91.96± 8.48
5. Patients with EDSS 5.0-6.5	33.50± 3.66	76.00± 10.57	89.66± 10.81	88.03± 11.06	87.61± 11.34
p1-2	**<0.01**	**<0.001**	**<0.05**	**<0.001**	**<0.001**
p1-3	**=0.053**	**<0.001**	>0.05	**<0.001**	**=0.069**
p1-4	**<0.01**	**<0.001**	**<0.01**	**<0.001**	**<0.001**
p1-5	>0.05	**=0.052**	>0.05	**=0.080**	>0.05
p3-4	>0.05	>0.05	>0.05	>0.05	**=0.071**
p3-5	>0.05	>0.05	>0.05	>0.05	>0.05
p4-5	>0.05	>0.05	>0.05	>0.05	>0.05

disorders, the circumferences of the shoulder in a tense, relaxed state and the forearm in the upper part are significantly (p<0.05) smaller or have a pronounced tendency (p=0.056) to smaller values compared to male patients with mild (by 11.92 % – 12.18 % – 11.17 %, respectively) and moderately severe (by 17.35 % – 17.08 % – 14.15 %, respectively) disorders, and the circumference of the chest has a pronounced tendency (p=0.059) to smaller values (by 8.63 %) compared to male patients with mild disorders; *in female patients* with moderate disorders, the circumferences of the shoulder in a tense, relaxed state and the lower forearm by 4.87 %, 5.01 % and 4.90 % tend (p=0.053-0.084) to be higher compared to female patients with mild disorders, and the circumference of the lower forearm by 7.53 % has a slight tendency (p=0.086) to be higher compared to female patients with moderate-severe disorders.

When analyzing *the gender differences in the circumference sizes of the upper limbs between patients with multiple sclerosis*, it was established (see Table 1): all indicators are significantly (p<0.05-0.001) higher in male patients of the general group, with mild and moderately severe disorders compared to the corresponding groups of female patients (from 10.47 % to 14.07 % in patients in general, from 12.17 % to 16.80 % in patients with mild disorders and from 14.35 % to 21.45 % in patients with moderately severe disorders).

When analyzing the differences in the *circumference sizes of the lower extremities between practically healthy* men or women *and those with multiple sclerosis*, it was established (see Table 2): *in patients with multiple sclerosis, men or women in general, in patients with mild, moderate and moderately severe disorders*, there were significantly (p<0.05-0.001) larger values of the circumferences of the lower leg (respectively in male patients by 13.24 % – 14.01 % – 7.39 % – 19.09 %, in female patients by 20.08 % – 21.30 % – 19.68 % – 17.56 %) and the foot (respectively in male patients by 8.61 % – 9.01 % – 6.45 % – 10.18 %, in female patients by 8.42 % – 8.82 % – 9.04 % – 5.57 %); *in male patients with multiple sclerosis* – in the general group, in patients with mild and moderately severe disorders, significantly (p<0.01-0.001) greater or insignificant tendency (p=0.085) to greater values of hip circumferences (by 7.40 % – 9.52 % – 8.23 %, respectively) and thighs (by 7.64 % – 8.48 % – 13.43 %, respectively), as well as in the general group and in patients with mild disorders, significantly (p<0.01-0.01) greater values of upper leg circumferences (by 4.14 % and 5.79 %, respectively); *in patients with multiple sclerosis women* – in the general group, in patients with mild and moderate disorders, significantly (p<0.01-0.001) larger or a trend (p=0.065) towards larger values of the thigh (respectively by 7.74 % – 8.66 % – 9.44 %), hips (respectively by 5.28 % – 5.11 % – 7.07 %) and upper leg (respectively by 4.05 % – 4.56 % – 5.34 %).

When analyzing the differences in the *circumference sizes of the lower extremities* between men or women *with multiple sclerosis with different degrees of disability*, it was established (see Table 2): *in male patients* with moderate impairments, the circumference of the hips has a pronounced tendency (p=0.059 in both cases) to lower values compared to male patients with mild (by 6.40 %) and moderately severe (by 10.48 %) impairments, and the circumference of the lower leg has a pronounced tendency (p=0.059) to lower values (by 5.81 %) compared to male patients with mild impairments; *in female patients* with moderate disorders, the circumferences of the thigh, hips, and upper leg have mostly insignificant trends (0.066-0.097) to higher values (8.83 % – 6.04 % – 6.22 %, respectively) compared to female patients with moderate-severe disorders.

When analyzing the *sex differences in the girth sizes of the lower extremities between patients with multiple sclerosis*, it was established (see Table 2): the girth of the lower leg in the upper part of male patients of the general group and with

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mild disorders is significantly (p<0.05 in both cases) larger compared to the corresponding groups of female patients (by 4.43% and 5.45%, respectively); the girth of the foot in male patients of the general group, with mild, moderate and moderately severe disorders is significantly (p<0.05-0.001) larger (by 8.85 % – 8.86 % – 6.47 % – 12.51 %, respectively) compared to similar groups of female patients; the girth of the hips in male patients with moderate to severe disorders has a pronounced tendency (p=0.054) to larger values (by 10.95 %) compared to a similar group of female patients; and also the hip circumference in female patients with moderate disorders is significantly (p<0.05 in both cases) larger (by 8.97 % and 5.21 %, respectively) compared to similar groups of male patients.

When analyzing the differences in *body circumferences between practically healthy men and those with multiple sclerosis*, it was established (see Table 3): *in men with multiple sclerosis* – in the general group of patients, in patients with mild and moderately severe disorders, significantly (p<0.05-0.001) larger or a tendency (p=0.063) to larger values of waist circumferences were established (by 10.71 % – 10.35 % – 22.84 %, respectively), chest circumferences during inhalation (by 3.70 % – 4.90 % – 9.00 %), during exhalation (by 9.14 % – 10.43 % – 15.90 %) and in a calm state (by 5.99 % – 7.14 % – 12.18 %, respectively); in patients with mild and moderately severe disorders, a significant (p<0.01) greater or insignificant trend (p=0.097) towards greater neck circumference values (by 3.27 % and 10.83 %, respectively), as well as a trend (p=0.075) towards smaller neck circumference values (by 3.11 %, respectively) were established in patients with moderate disorders; in female patients with multiple sclerosis – in the general group of patients, in patients with mild, moderate and moderately severe disorders, significantly (p<0.001 in all cases) greater or trends (p=0.052 and p=0.080) towards greater values of waist circumference (by 11.92 % – 9.60 % – 15.11 % – 10.18 %, respectively) and chest circumference on exhalation (by 9.68 % – 8.43 % – 12.23 % – 6.47 %, respectively); in the general group of patients, in patients with mild and moderate disorders, significantly (p<0.01-0.001) greater or trends (p=0.053 and p=0.069) to greater values of neck circumferences (by 3.72 % – 2.72 % – 4.44 %, respectively) and chest circumferences in a calm state (by 5.11 % – 3.50 % – 7.76 %, respectively), as well as in the general group of patients and patients with moderate disorders, significantly (p<0.05-0.01) greater values of chest circumferences during inspiration by 3.18 % and 5.36 %, respectively.

When analyzing the differences *in trunk circumferences between* men or women with *multiple sclerosis with different degrees of disability*, it was found (see Table 3): *in male patients* with moderate impairments, the circumferences of the neck and chest during inhalation, exhalation and at rest were significantly (p<0.05 in all cases) smaller compared to male patients with mild (by 6.17 % – 7.94 % – 8.37 % – 8.33 %, respectively) and moderately severe impairments (by 12.57 % – 11.40 % – 12.69 % – 12.45 %, respectively); in male patients with moderate-severe disorders, neck circumference is significantly (p<0.05) greater (by 6.83 %) compared to male patients with mild disorders, and waist circumference has a slight tendency (p=0.089) to greater values (by 14.54 %) compared to male patients with moderate disorders; *in female patients* with moderate disorders, only chest circumference at rest tends (p=0.071) to greater values (by 3.95 %) compared to female patients with mild disorders.

When analyzing *gender differences in body circumferences between patients with multiple sclerosis*, it was found (see Table 3): all indicators were significantly (p<0.05-0.001) greater in male patients of the general group, with mild and moderately severe disorders compared to the corresponding groups of female patients (from 10.70 % to 14.43 % in patients in general, from 12.41 % to 15.60 % in patients with mild disorders and from 17.74 % to 22.16 % in patients with moderately severe disorders), and only the neck circumference in male patients with moderate disorders was significantly (p<0.05) by 8.55 % greater compared to the similar group of female patients.

The study of body circumference parameters in patients with multiple sclerosis is an important direction for establishing the relationship between somatotype, risk of development and severity of this disease. There is a significant amount of evidence that somatometric characteristics, in particular body mass index (BMI), waist circumference, height and body types, may be associated with the risk of central nervous system pathologies, including multiple sclerosis, as well as with morphofunctional features of the brain.

A number of studies demonstrate the relationship between somatotype and features of cerebral circulation. Thus, in women with an ectomorphic body type, statistically significant correlations have been established between smaller values of chest and pelvic circumference and reduced blood supply to the frontal, parietal and occipital areas of the cerebral cortex, which may have functional consequences for cognitive processes [17]. This is consistent with data suggesting that smaller anthropometric dimensions may be a marker of reduced cerebrovascular reactivity or reduced neuroplastic reserve.

In the context of multiple sclerosis, researchers have noted that increased BMI in childhood and adolescence is significantly associated with an increased risk of developing multiple sclerosis. Thus, the results of a meta-analysis that included more than 20 studies indicate that excess body weight before the age of 20 years is associated with a risk of developing multiple sclerosis of 1.75 (95 % CI: 1.47-2.10) [11]. Studies by Hone L. et al. also indicate that an increase in BMI at the age of 7 years is already a predictor of the risk of multiple sclerosis in adulthood, and this relationship is stronger in women [9].

In addition to the risk of occurrence, anthropometric parameters are also important for the prognosis of the course of multiple sclerosis. Patients who were overweight before diagnosis have been found to have a higher probability of more rapid progression of disability. In a cohort of over 8,500

patients, an elevated BMI before multiple sclerosis onset was associated with a 20 % higher risk of reaching an EDSS score of 4.0 compared with patients with a normal BMI [12].

E. Matusik et al. found that patients with multiple sclerosis exhibit changes in body composition: a decrease in muscle mass and an increase in fat tissue, which is significantly correlated with disease duration, disability level, and use of glucocorticosteroid therapy [13]. Such changes in body composition not only reduce physical function, but may also indirectly affect brain status, in particular white matter volume and brainstem structure [20].

The general relationship of anthropometric parameters with neuroanatomical structures should also be taken into account. For example, in a Turkish population, height and head circumference have been shown to be associated with the volume of the basal ganglia and thalamus, which play a key role in motor coordination and cognitive processes [20]. Similarly, morphometric features of the middle cranial fossa in individuals with meso- and brachycranial skull shapes have been associated with changes in the spatial organization of brain structures, which could potentially affect the course of multiple sclerosis [6]. Particular attention should be paid to the relationship between anthropometric parameters and the risk of other CNS pathologies. For example, a large cohort study found that a 5-unit increase in BMI was associated with a 10 % increase in the risk of gliomas [7]. A systematic review also found that every 5 kg/m² increase in BMI increases the risk of brain tumors by 12 % [24]. Thus, somatotype may play a role not only in the etiology of multiple sclerosis, but also in the development of comorbidities.

In addition, it is worth considering the data of the Mendelian randomization study, which demonstrated a causal relationship between high BMI, low physical activity and an increased risk of developing multiple sclerosis. For example, genetically determined high BMI is associated with a 41 % higher risk of multiple sclerosis [23].

It is also necessary to take into account that the morphological variability of brain structures may be associated with anatomical features of the skeleton and skull. I. Zhuravlova et al. found significant variability in the parameters of the IV ventricle of the brain, which is of practical importance in neuroimaging of patients with multiple sclerosis, since the volume of the ventricles is a marker of progressive atrophy [25].

Finally, it is worth noting that the features of the somatotype also affect psychological characteristics and reactions to stress. It has been found that women with a mesomorphic somatotype have higher stress tolerance and more adaptive personality traits, which can potentially modify the course of chronic neurological diseases [1].

Thus, anthropometric parameters are important both in the context of the risk of developing multiple sclerosis and in relation to its course, damage to brain structures, changes in body composition and concomitant CNS pathologies. Their consideration is appropriate both in clinical monitoring of patients and in the development of personalized rehabilitation and secondary prevention programs.

Conclusion and prospects for further developments

1. Between practically healthy and multiple sclerosis patients, numerous significant or trends in differences in body circumferences were established (in most cases, higher values in patients). Between multiple sclerosis patients with mild, moderate and moderately severe disorders, numerous significant or trends in differences were established only for the circumferences of the upper limbs and trunk in men.

2. Among multiple sclerosis patients, pronounced manifestations of sexual dimorphism were established for most of the circumferences of the upper limbs and trunk (higher values in men in general groups, in patients with mild and moderately severe disorders).

Further study of the features and sexual differences in skinfold thickness in Ukrainian men and women with multiple sclerosis with varying degrees of disability is planned.

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ОСОБЛИВОСТІ ОБХВАТНИХ РОЗМІРІВ ТІЛА В УКРАЇНСЬКИХ ЧОЛОВІКІВ І ЖІНОК, ХВОРИХ НА МНОЖИННИЙ СКЛЕРОЗ

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Анотація. *Множинний склероз є хронічним аутоімунним захворюванням центральної нервової системи, що супроводжується широким спектром неврологічних порушень. Соматичні характеристики пацієнтів, зокрема антропометричні показники, можуть відігравати роль у клінічному перебігу хвороби та її прогнозуванні. Вивчення тілобудови у хворих різної статі дозволяє виявити потенційні гендерні особливості, які можуть бути корисними для персоналізованого підходу в діагностиці та лікуванні. Актуальність дослідження обумовлена потребою в комплексному розумінні взаємозв'язків між соматотипологічними параметрами та нейродегенеративними процесами. Мета дослідження – встановлення особливостей та статевих розбіжностей обхватних розмірів тіла в українських чоловіків і жінок молодого віку, хворих на множинний склероз із різним ступенем інвалідизації. Проведено визначення обхватних розмірів тіла у 35 українських чоловіків і 59 жінок молодого віку, хворих на множинний склероз із легкими, помірними та помірно-тяжкими порушеннями. Первинні обхватні розміри тіла 82 практично здорових українських чоловіків і 101 жінки аналогічного віку взяті з банку даних науково-дослідного центру Вінницького національного медичного університету ім. М. І. Пирогова. Статистичний аналіз проведений у ліцензійному пакеті «Statistica 6.0» з використанням непараметричних методів оцінки. При порівнянні обхватних розмірів тіла між практично здоровими та хворими на множинний склероз чоловіками або жінками встановлені багаточисельні достовірні або тенденції відмінностей: в усіх групах хворих чоловіків і жінок – більші значення обхватів передпліччя й гомілки у нижній частині та стопи; в усіх групах хворих чоловіків – більші значення обхватів передпліччя у верхній частині; в усіх групах хворих і жінок – більші значення обхватів кисті, талії та грудної клітки на видиху; в більшості груп хворих чоловіків і жінок – більші значення інших обхватних розмірів верхніх, нижніх кінцівок і тулуба. Між хворими на множинний склероз чоловіками або жінками багаточисельні достовірні або тенденції відмінностей встановлені лише для обхватів верхньої кінцівки та тулуба у чоловіків (менші значення у хворих із помірними порушеннями порівняно з легкими та помірно-тяжкими порушеннями). Між хворими на множинний склероз чоловіками та жінками встановлені виражені прояви статевого диморфізму усіх обхватних розмірів верхніх кінцівок і тулуба (достовірно більші значення у хворих чоловіків загальної групи, з легкими та помірно-тяжкими порушеннями).*

Ключові слова: *нервові захворювання, множинний склероз, обхватні розміри тіла, практично здорови та хворі чоловіки й жінки, статеві розбіжності.*