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ORIGINAL SCIENTIFIC PAPER

Biogeometric Profile of the Posture as a Factor of Men's Functional Assessment of Movements in the Early Middle Age

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Abstract

The research of the physical development of men in the early middle agewith different types and levels of biogeometric profile in the course of health fitness classes are presented. Subjects: 50 men of 35-45 years old engaged in physical activities. Visual screening of the biogeometric profile state of men's posture has been used to assess the indicators in the sagittal and frontal planes. It was specified the indicators of the state level of the biogeometric profile of the different types of posture with men in the early middle age. Comparative analysis of indicators of functional assessment of men's movements (using Functional Movement Screen) showed statistically significant decrease ($p<0.01$) in motor skills in all test exercises depending on age. Analysis of variance showed that the level of the state of the biogeometric profile of posture of men of the early middle ageis statistically significant ($p<0.05$) affects the functional assessment of the movement. Analysis of the dependence of functional assessment of movements on the level of biogeometric profile of the posture of men 36–45 years found that the maximum differences are observed between men 36–40 years and 41–45 years with a high level of biogeometric profile of their posture, and the minimum in men with average level, however, there are no statistically significant differences between the functional assessment of the movement of men 36–40 and 41–45 years with different levels of biogeometric posture profile.

Keywords: *biogeometric profile, posture, men, early middle age, movement functional assessment*

Introduction

For the wide range of researchers, the state of health of the modern population is of serious concern (Kashuba, Rudenko, Khabynets, & Nosova, 2020; Hakman et al., 2020). Scientists note that the highest morbidity rate in the class of circulatory system diseases the second place is occupied by diseases of the organs, the third rank is occupied by diseases of the musculoskeletal system (Ettinger, Wright, & Blair, 2006; Andrieieva et al., 2019; Goncharova et al., 2020). The urgency of the problem of the awareness of the phenomenon of spatial organization of the human body can be traced:

- in the late twentieth and early twenty-first centuries the growing trend of disorders of the spatial organization of the human body, in particular, a decrease in the biogeometric profile state of posture, is of thorny issue. It is the most relevant for the living conditions of humans in megapolises (Kashuba

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et al., 2017);

- the increasing value of human individuality in the modern world and increased perception of everything related to personal self-expression, and biogeometric profile of posture is one of the characteristics of this individuality (Tkachova et al., 2020);
- the formation of the spatial organization of the body in the conditions of modern civilization as one of the characteristics of physical health (Kashuba et al., 2019);
- the increased importance of issues of image in the modern society as the ability to present themselves to the society in the proper state of spatial organization of the men's body. The questions on the factors that affect the state of the spatial organization of the body of men were taken into consideration.

As the result of summarizing over 100 research articles it was concluded the study of the biogeometric profile of the men's posture in the early middle age is relevant and has the theoretical, practical and social significance for improving the health of adulthood people.

Methods

Visual screening of the state of the biogeometric profile posture of men aged 35-45 years used the express-control cards. The researchers assessed a number of indicators: in the sagittal plane – the position of the head and torso relative to the vertical axis, the state of thoracic kyphosis and lumbar lordosis, the shape of the abdomen, the angle in the biopairs of the thigh and lower leg; in the frontal plane - the location of the shoulders, lower corners of the shoulders and pelvis, waist triangles, the position of the feet. The researchers received an integrated assessment – the maximum number of points – 33 (subject was evaluated of all 11 indicators in 3 points), and the minimum – 11 (subject was evaluated of all 11 indicators in 1 point) points (Kashuba, Bibik, & Nosova, 2012).

The researchers used the Functional Movement Screen (FMS) Testing by American Physiotherapists Cook, Burton, Hoogenboom and Voight (2014) to identify the functional assessment of movements of men in early middle age. Those are the following: 1 –Deep Squat; 2 – Hurdle Step; 4 – In Line Lunge; 4 – Shoulder Mobility; 5 – Active Straight Leg Raise; 6 – Trunk Stability Push Up; 7 – Rotary Stability.

During testing, the subject performs three attempts in each test, the best result of which is recorded. Evaluation system has the following levels: score 3 – absolutely correct performance of the test, without compensatory movements, loss of body balance, etc.; score 2 – performance of the test with compensatory movements or in a light version; score 1 – failure to perform the test or its implementation is not in full; score 0 - performing a test with pain. Three coaches of "GYMMAXX" fitness-club with at least 5 years of experience were the assessors.

Subjects

50 men of 36–45 years old were selected randomly from clients of "GYMMAXX" fitness-club. They have been divided into two subgroups: 36–40 and 41–45 years old. Everyone gave written consent to participate in this research according to the recommendations of the Ethics Committee, in accordance with the ethical standards of the Helsinki Declaration.

Statistical analysis

The following methods of mathematical statistics were used: descriptive statistics, analysis of variance (ANOVA). The following parameters were determined: mean ($\overline{x}$), standard deviation (SD), standard error (m). One-factor ANOVA was used to analyze the impact of the biogeometric profile of men's posture on their physical fitness. Two-factor ANOVA determined the influence of the biogeometric profile of men's posture and the posture type on the physical qualities of men in early middle age. The Duncan's ranking criterion for multivariate comparisons was used to analyse the movement functional assessment and level of biogeometrical profile posture of men by pairwise comparisons of averages between the groups. The analysis was performed using the Statistica 10.0 (StatSoft, Inc).

Results

The research of the somatoscopic indicators of men of 36 – 45 years old determined that among the persons under study the disturbance in the sagittal plane with the increase of physiological curves of the spine – flat back dominates: among men of 36 – 40 years old there were recorded 36.4%, and among men of 41 – 45 years old – 42.9%. The distributionof 36-40-year-old men by levels of biogeometric posture profile showed that among men with normal posture, men with medium and high levels of biogeometric profile were equally distributed and their shares were 13.6%. Moreover, among men with a round back there was 9.1% larger proportion of low level than that of the medium level, as well as the patients with scoliotic posture in which the difference between the shares was 4.5%, and among the men with flat back, on the contrary, the proportion of the medium level of biogeometrical profile posture dominated the share with a low level over 4.5%.

Those data allowed establishing that the level of the biogeometric profile posture of 36-40 year-old men is ($\overline{x}$ ±SD) 18.59±6.12 points and of 41–45 year-old men– 16.57±4.82 points (Table 1).

Table 1. Characteristics of the biogeometric profile of the posture of men 36–45 years old (n=50)

Parameters of of the biogeometric profile of the posture, point				
Age, years	**Statistical characteristic**	**Frontal plane**	**Sagittal plane**	**The state of biogeometric profile posture**
36–40 (n=22)	$\overline{x}$	8.86	9.73	18.59
	SD	3.06	3.30	6.12
	m	0.65	0.70	1.31
41–45 (n=28)	$\overline{x}$	7.71	8.86	16.57
	SD	1.80	3.08	4.82
	m	0.34	0.58	0.91

It was identified that the level of the biogeometric profile posture in the frontal plane is 14.0% higher inmen 36-40 years old, in the sagittal – 8.23% higher, and the overall level of the biogeometric profile of posture is 10.9% higher than of men 41-45 years old (Figure 1).

It has been found that the decrease in the biogeometric

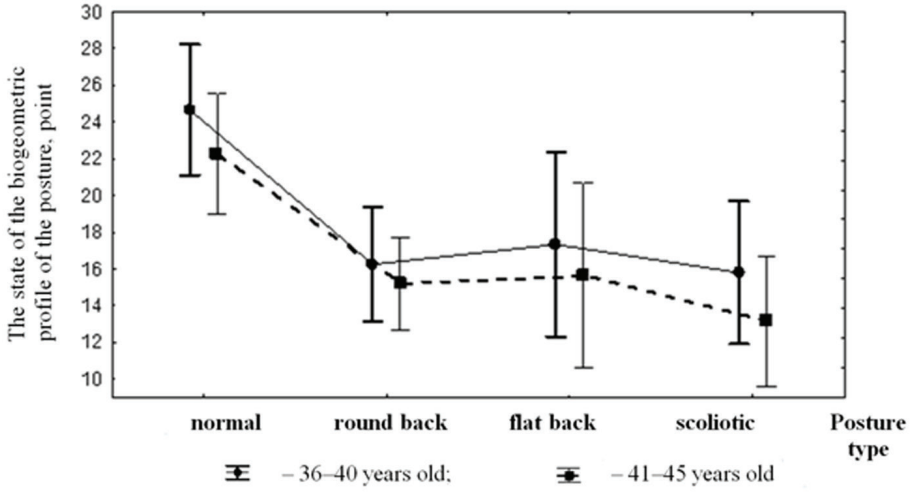

FIGURE 1. The level of the biogeometric profile of the posture, depending on the posture type of men (n=50)

posture profile of men of both subgroups does not cause statistically significant (p>0.05) changes in body length and weight.

Men in the early middle age have a tendency to a gradual decrease in the state of the biogeometric profile of posture, regardless of the type of disorders, but the difference between the indicators is statistically nonsignificant (p> 0.05) (see Figure 1).

The next question: how do posture disorders affect the functional assessment of the movements of men in the early middle age? According to the peculiarities of the development of men's physical qualities in the early middle age, it was found that 9.1% (n=2) men of 36–40 years performed the "Deep Squat" test absolutely correctly, without compensatory movements and loss of body balance and no man of 41–45 years old performed this test;18.2% (n=4) men of 36–40 years old and 7.1% (n=2) men of 41–45 years old performed "Hurdle Step" test; 9.1% (n=2) and 10.7% (n=3)–"In-Line Lung" test; 13.6% (n=3) and 7.1% (n=2) – "Active Straight Leg Raise" test; 9.1% (n=2) and 3.6% (n=1) respectively – "Trunk Stability Push Up-"and "Rotary Stability"each test. On the other hand, absolutely no one man in each of the 2 subgroups was able to perform the correct movement when performing the "Shoulder Mobility" test.

Comparative analysis of indicators of functional assessment of men's movements showed a decrease in motor skills in all test exercises, which was observed with age (Table 2). Thus, the results in men of 40–45 years old were lower compared to men of 35–40 years old and statistically significant differences were recorded as follows: "Deep Squat" – by 16.3% (p<0.05); "Hurdle Step" – by 14.0% (p>0.05); "In-Line Lung" – by 20.5% (p<0.01); Shoulder Mobility – 28.6% (p<0.01); Active Straight Leg Raise – 14.6% (p>0.05); "Trunk Stability Push Up" – 21.6% (p<0.05); Rotary Stability – 16.7% (p>0.05).

Table 2. Comparative analysis of indicators of movement's functional assessment of men 36–45 years old (n=50)

		Evaluation, point						
Age, years	**Statistical characteristic**	**Deep Squat**	**Hurdle Step**	**In Line Lunge**	**Shoulder Mobility**	**Active Straight Leg Raise**	**Trunk Stability Push Up**	**Rotary Stability**
36–40 (n=22)	$\overline{x}$	1.95	1.95	2.0	1.59	1.86	1.68	1.64
	SD	0.49	0.65	0.44	0.50	0.64	0.65	0.66
	m	0.10	0.14	0.09	0.11	0.14	0.14	0.14
41–45 (n=28)	$\overline{x}$	1.64	1.68	1.59	1.14	1.59	1.32	1.36
	SD	0.49	0.48	0.59	0.35	0.50	0.48	0.49
	m	0.09	0.09	0.11	0.07	0.09	0.09	0.09
t		2.22	1.63	2.81	3.59	1.63	2.17	1.66
p		0.031	0.110	0.007	0.001	0.110	0.035	0.103

It was found that the overall score of men 36–40 years was 12.67±2.71 points against 10.32±1.81 points for men 41–45 years, i.e.for men 36–40 years the score was 18.6% more. Statistically significant differences (p<0.01) were proved between the indicators of functional assessment of men's movements depending on age.

ANOVA showed that the level of the state of the biogeometric profile of posture of men of the early middle age is statistically significant (p<0.05) affects the functional assessment of the movement. Men with a high level of biogeometric posture profile have a higher functional assessment of movement compared to low, which is characteristic of both age subgroups (Kashuba et al., 2020). Analysis of the dependence of functional assessment of movements on the level of biogeometric

profile of the posture of men 36–45 years found that the maximum differences are observed between men 36–40 years and 41–45 years with a high level of biogeometric profile of their posture, and the minimum in men with average level, however, there are no statistically significant differences between the functional assessment of the movement of men 36–40 and 41–45 years with different levels of biogeometric posture profile (Figure 2).

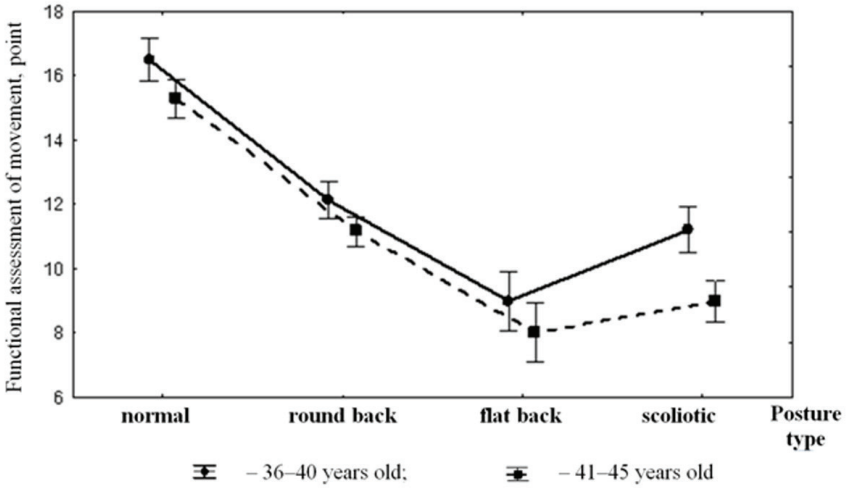

FIGURE 2. The influence of posture type on the functional assessment of the movement of men (n=50)

Some tests that assess the right and left sides, namely the "Hurdle Step", "In-Line Lung", "Shoulder Mobility", "Active Straight Leg Raise" and "Rotary Stability" tests were repeated by men for the right and left upper (or lower) limb, but statistically significant differences were not found between the functional assessment of movements ($p>0.05$). However, some posture disorders cause asymmetry. In particular, asymmetry was registered in 9.1% (n=2) of men aged 36-40 when performing the "Hurdle Step" test, namely in 4.5% with a round back and in 4.5% with a scoliotic posture. Moreover, each of them was characterized by a low level of biogeometric posture profile. In this test exercise, asymmetry was observed in 10.7% (n=3) of men 41–45 years with a low level of biogeometric posture profile, of which 3.6% had a round back, and 7.1% – scoliotic posture. Asymmetry was not detected in men 36–40 years when performing the "In-Line Lung" test, but asymmetry was detected in 3.6% (n=1) of men 41–45 years with a flat back with a low level of biogeometric profile of posture. Asymmetry was not recorded in men aged 36– 40 years during the "Shoulder Mobility" test, while 7.1% (n=2) of men aged 41–45, 3.6% of whom had a round back, and 3.6% – scoliotic posture was characterized by asymmetry at low level of biogeometric posture profile. Asymmetry was stated in 4.6% (n=1) men 36–40 years and 10.7% (n=3) men 41–45 years with scoliotic posture and low level of biogeometric profile of posture during the "Active Straight Leg Raise" test. At the same time, asymmetry was established in 4.6% (n=1) of men 36–40 years old and 17.9% (n=5) men 41–45 years old with scoliotic posture and low level of biogeometric posture profile during the determination of rotational stability (Kashuba, Lopatskiy, & Rudenko, 2017).

Discussion

The problem of men's health in adulthood has been the subject of a number of theoretical and experimental studies, in particular, the authors focused on: methods of health and recreational beach volleyball with mature men in sanatorium conditions (Yarish, 2009); complex methods of physical culture and health classes with middle-aged men on the basis of the integration of football and general physical training (Ghosn, 2013); training program for middle-aged men based on the use of strength exercises in a dynamic mode (Karpov, 2010); the influence of fitness aerobics, cycle aerobics, Cross Fit, on TRX simulators on the physical condition of men in first and second mature age (Yurchuk, 2011); approaches to the organization of fitness programs for men of mature age with the use of exercise equipment in a fitness club (Chernyshova, 2012); program of preventive and health-oriented classes with the use of table tennis for mature men engaged in mental work (Penzai, 2014); program for the health correction of men aged 25–40 years, suffering from obesity 1-2 degree and hypertension 1A, using the "Multidoctor" simulator and the use of dietary supplements Trekrezan (Golovanov, 2015); the program of health fitness classes with the use of "Outdoor activity", aimed at correcting the physical condition of men of the second mature age (Apaychev, 2016); game fitness technology (on the example of basketball), the disclosure of its organizational and methodological, technical and tactical, physical culture and health characteristics and determining the place in the system of modern fitness (Perevoznikova, 2017).

Our research by the analysis of movement functional assessment (using the system of tests Functional Movement Screen) and level of biogeometrical profile posture of men by pairwise comparisons of averages between the groups using the Duncan's ranking criterion for multivariate comparisons allowed to reveal the following: the functional assessment of the movement in the group of men of 36-40 years old with a high level of biogeometrical profile posture is statistically significantly higher ($p<0.05$) thanin the group of men with medium and low levels of both age subgroups. At the same time, it was confirmed that in group of men of 36-40 years old with the average level of biogeometric profile posture, the functional assessment of movement is statistically significantly higher ($p<0.05$) than in the group of men with a low level of both age subgroups. It should be noted that in group of men of 36-40 years old with a low level of biogeometric profile posture, the functional assessment of movement is statistically significant higher ($p<0.05$) than in the group of men with a low level of

both age subgroups. However, there are no statistically significant differences ($p>0.05$) between the functional assessment of movement of men with the same level of biogeometric posture profile depending on the age subgroup. The use of analysis of variance (ANOVA) allowed to establish a statistically significant ($p<0.05$) effect of the biogeometric profile posture of men of 36-45 years old on the endurance of the abdominal muscles and mobility of the hip joint and lumbar spine (Kashuba et al., 2019).

The above data have indicated that at the process of developing the corrective and preventive measures for the men of the early middle age, it is necessary to take into account not only the level of the biogeometric profile of their posture, but also to take into account the indicators of functional assessment of movements.

Taking this into account, special attention should be paid to the features of the spatial organization of their body, and corrective and preventive complexes should be developed in accordance with the level of the biogeometric profile of their posture. We get the further development of knowledge on the regulation of human body's pose (Laputin, Gruzin, & Khmelnitska, 1995) in the diagnosis of the state level of the biogeometric profile of men's posture in the course of health fitness classes (Kashuba et al., 2020).

Therefore, it can be argued that men in early middle age have a gradual increase in asymmetry, and its threat increases along with a decrease in the state of biogeometric profile of posture. In addition, despite lower scores on the functional movements of men with flat backs in both groups, due to the risk of asymmetry in the development of physical qualities, scoliotic posture was the most unfavorable type of disorder. However, there are lower functional estimates of movement in men 41–45 years compared to men 36–40 years, regardless of posture type (Kashuba et al., 2018).

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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