

Effect of health fitness on the state of posture's biogeometric profile and physical preparedness of 36-45-year-old men

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Abstract:

Correction and improvement of the biogeometric profile of the men's posture in early middle age is one of the problems in the field of fitness, because this category of the population has the greatest work and life experience, which is of particular value to society as a whole. *The purpose of the work* was to study the effectiveness of the technology of correction of disorders in the biogeometric posture profile of mature men in the process of health fitness. *Participants*: 50 men of 35-45 years old engaged in physical activities. *Methods*: Visual screening of the biogeometric posture profile, tests of physical condition. *Results*: Such posture disorders as round back predominate among men aged 36–45 years: 36.4% were recorded among men aged 36–40 years, and 42.9% among men aged 41–45 years. The distribution of men aged 36–40 years showed that among those with normal posture, men with medium and high levels of biogeometric posture profile were distributed equally and their shares were 13.6%. 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. A statistically significant effect of the level of the biogeometric profile of the posture of men aged 36-45 years on the endurance of abdominal muscles and flexibility of the hip joint and lumbar spine ($p < 0.05$) was established. The technology for correction of biogeometric profile of the posture was developed. It consisted of three stages: involving, corrective, supportive and included conceptual, organizational diagnostic components and also the assessment of corrective and preventive measures effectiveness according to certain criteria. *Conclusions*: The use of the developed technology contributed to the increase of physical fitness of the men in early middle age: in the endurance of the abdominal muscles in the group of the men of 36-40 years old by 7.85 %, and in the group of the men of 41-45 years old by 7.83 % and positive changes in the mobility of the hip joint and lumbar spine in the both subgroups of men ($p < 0.05$). As a result of pedagogical experiment, the proportion of 36-40 years men with normal posture increased by 31.8% and in 41–45 years men by 17.9%. The state of the biogeometric profile of posture of men 36-45 years aging improved statistically significant in both frontal and sagittal planes after the experiment ($p < 0.05$).

Key words: biogeometric profile, posture, men, early middle age, fitness

Introduction

In the space of socio-philosophical knowledge, the health of adults is of great importance. Today scientific researchers (Apaychev, 2016; Diachenko-Bohun et al., 2020; Kashuba et al., 2019) approved that the highest incidence in the class of diseases of the circulatory system, the second place in the structure of morbidity was occupied by diseases of the musculoskeletal system. Over the past 10 years, reputable international organizations (UN, WHO, Council of Europe, governing bodies of the European Union) have been drawing the attention of governments to the need to create favorable conditions for encouraging citizens to exercise. The position of the international scientific community, many state and international organizations on the phenomenon of man and way of life is based on the understanding of the importance of health itself and the unconditional urgency of the problem of human survival. The global nature of the scientific problem of population health decreasing has prompted scientists, in addition to a partial consideration of certain issues of public health, to propose conceptual provisions for the organization of measures to protect and promote the health of various segments of the population. Stimulation of health-improving motor activity is especially actual for a contingent of persons of mature age, the period of the greatest realization of person's social function. Socio-cultural demand has determined the need for development and introduction of innovations in the field of physical culture and sports. The health fitness industry responds quickly to the changing socio-cultural demands of society in this segment and creates optimal conditions for the development of new areas and types of physical activity (Grygus, 2017, 2020; Kashuba, Lopatsky & Vatamanyuk, 2017). Currently, the paradigmatic changes

taking place in the system of fitness, put it in the face of new theoretical and methodological problems and advanced innovations (Kashuba et al., 2021).

Correction and improvement of the biogeometric profile of the men's posture in early middle age is one of the problems in the field of fitness, because this category of the population has the greatest work and life experience, which is of particular value to society as a whole (Kashuba, Lopatskyi & Prylutska, 2017; Hakman et al., 2020). Since a significant proportion of modern men has a low level of biogeometric posture profile, there is a decrease in physical fitness, for the vast majority of men of the second period of adulthood it is more acceptable to engage in fitness than aerobic or strength training (Ettinger, Wright & Blair, 2006; Kashuba et al., 2020).

The purpose of the work was to study the effectiveness of the technology of correction of disorders of the biogeometric profile of the posture of mature men in the process of health fitness.

Systematization and generalization of references allows us to state that, despite the attention of professionals, insufficient development of technology for correction of disorders in the biogeometric profile of the posture of men in early middle age during the process of health fitness. Scientists (Penzai, 2014, Kashuba et al., 2019) note that the aging of the population at the present stage is of great importance in the socio-economic life of society. A sharp decline in fertility, negative natural population growth make real predictions of demographers that by 2025 the number of people over 60 will exceed 1 billion and will be 15% of the total population (Semenov, 2009). In view of this, the implementation of this work will contribute not only to the correction of disorders of the biogeometric profile of human posture in the later stages of ontogenesis, but also to improve the quality of life and increase motor activity.

Material & Methods

Participants: 50 men of 36–45 years old were selected randomly from clients of “GYMMAXX” fitness-club (Kyiv city). 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.

Procedure/Measure: We used the data generalization of scientific and methodological literature and practice experience, anthropometry, pedagogical testing, pedagogical experiment and analysis of men's posture by program "Torso" (Kashuba et al., 2007). 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, Khmelnitskaya & Nosova, 2006; Kashuba, Bibik & Nosova, 2012).

The "Tilt forward in a sitting position with legs extended forward" test was used to assess the mobility of the hip joint and lumbar spine. Abdominal muscle endurance was determined by performing the "Incomplete flexion of the torso from a lying position" test.

Data collection and analysis: The following statistical methods were used: descriptive statistics and analysis of variance (ANOVA). The following parameters were determined: arithmetic mean \bar{x} , standard deviation – SD, standard error (m). The Shapiro Wilk test was used in testing for normality. As the samples of men's anthropometric, physical fitness parameters and biogeometric profile of posture were normally distributed t-test for independent samples was used to determine the statistical significance of the differences between two subgroups: 36-40 & 41-45 years old men and t-test for dependent samples was used to determine the differences between the same subgroups after vs before the experiment. One-factor ANOVA was used to analyze the impact of the biogeometric profile of men's posture on their physical preparedness. 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 physical preparedness assessment and level of biogeometrical profile posture of men by pairwise comparisons of averages between the groups. A significance level was assumed to be $p = 0.05$. Some results were obtained at higher levels of significance $p = 0.01$ and $p = 0.001$. The calculations were performed using the Statistica 10.0 (StatSoft, Inc).

Results

Studying the data of men's medical records, we noticed a negative trend associated with an increase in their proportion with posture disorders with aging. It was found that such posture disorders as round back predominate among men aged 36–45 years: 36.4% were recorded among men aged 36–40 years, and 42.9% among men aged 41–45 years. The distribution of men aged 36–40 years according to the levels of biogeometric posture profile showed that among those with normal posture, men with medium and high levels of biogeometric posture profile were distributed equally and their shares were 13.6%. At the same time, among men with a round

back there was a 9.1% higher share with a low level than with an average, as well as among those with scoliotic posture, in whom the difference between the shares was 4.5%, and among men with a flat back on the contrary, the share with the average level of the biogeometric profile of the posture exceeded the share with the low level by 4.5%. It was found that among men 41–45 years of age with normal posture, the share with a high level of biogeometric posture profile is 10.8% smaller than with the average level. It was determined that the state of the biogeometric profile of posture in men 36-40 years is on average (\bar{x} ; SD) 18.59; 6.12 points, and in men 41-45 years – 16.57; 4.82 points.

In contrast to body length, men aged 41–45 years had a statistically significant body weight higher ($p < 0.05$) than the body weight of men aged 35–40 years, and this excess was 4.88 %. Moreover, there was a statistically significant increase in body girth ($p < 0.05$), namely a 6.90 % increase in waist circumference and a 3.98 % increase in hip circumference (Table 1).

Table 1. Data of comparative analysis of physical development of men 36 - 45 years (n = 50)

		Height, cm	Weight, kg	Waist circumference, cm	Hip circumference, cm
36 – 40, n=22	\bar{x}	175.77	76.36	81.68	92.41
	S	4.88	4.99	5.76	2.50
	m	1.04	1.06	1.23	0.53
41 – 45, n=28	\bar{x}	176.27	80.09	87.32	96.09
	S	3.67	3.53	5.05	2.97
	m	0.78	0.75	1.08	0.63
	t	0.385	2.873	3.446	4.470
	p	0.702	0.006	0.001	0.001

Estimation of the Kettle index showed that men aged 41–45 years were statistically significant higher ($p < 0.05$), namely 4.18% than men aged 35–40 years ($25.80 \text{ kg} \cdot \text{m}^{-2}$ vs $24, 76 \text{ kg} \cdot \text{m}^{-2}$), but the index of the ratio of waist circumference to hip circumference is does not differ statistically significant ($p > 0.05$).

It has been found that the decrease in the biogeometric posture profile of men of both subgroups does not cause statistically significant changes in body length and weight ($p > 0.05$). 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 ($p > 0.05$). It was found that the decrease in the level of the biogeometric profile of the posture of men of both subgroups does not cause statistically significant changes in length and body weight ($p > 0.05$). With this in mind, when developing the technology of correction of posture disorders of men in early middle age by means of health fitness, the special attention should be paid to the spatial organization of their body, and correctional complexes should be developed taking into account the level of biogeometric profile of their posture.

The next question: how do posture disorders affect the physical preparedness of men in the early middle age? The results were expected, according to which the indicator "Incomplete flexion of the torso from the supine position" in men 36 - 40 years by 21.35 % exceeds the results of men 41 - 45 years.

The differences between the results of the test exercise were statistically significant ($p < 0.05$). At the same time, when performing the test exercise "Leaning forward in a sitting position with outstretched legs", the recorded results of men aged 36-40 were 24.39 % higher than those of men aged 41-45. There was also a statistically significant ($p < 0.05$) decrease in flexibility in men of the older subgroup.

Thus, posture disorders are a negative factor that accelerates the rate of decline in physical fitness of men in the early middle age, including endurance of abdominal muscles and mobility of the spine. Moreover, it can be argued that the rates of endurance of the abdominal muscles and mobility of the hip joint and lumbar spine in men with normal posture exceed those of men with posture disorders in both subgroups. However, it can be noted that along with the previous stages of the study, there is a decrease in physical preparedness of men 41 - 45 years compared to men 36 - 40 years, which can be explained by regular age-related changes in the human body – homeoresis.

A statistically significant effect of the level of the biogeometric profile of the posture of men aged 36-45 years on the endurance of abdominal muscles and flexibility of the hip joint and lumbar spine ($p < 0.05$) was established by ANOVA. It has been confirmed that a decrease in the level of the biogeometric profile of the posture of men in both subgroups causes a decrease in the endurance of the abdominal muscles. Thus, the obtained results indicate the need to develop technology for the correction of disorders of the biogeometric profile of the posture of men of the second period of adulthood in the process of health fitness.

Based on the conducted ascertaining experiment, the authors' technology was developed. The purpose of the technology is to substantiate and implementate the corrective and preventive measures aimed at elimination of the disorders in biogeometric profile of the posture of men in early middle age during the health fitness training,

to improve its health. This technology is based on the principles of consistency, unity of theory and practice, determinism, wellness orientation, and its conceptual basis is humanistic, axiological, personality-oriented, activity-based and technological approaches. The technology has got three stages: retracting, corrective, and supporting. It includes conceptual, organizational, diagnostic, informational, corrective, programming and methodical components and contains the assessment of the effectiveness of corrective and preventive measures based on certain criteria.

The analysis of men's posture type after the experiment (duration 9 months) showed that among the men of 36-40 year-old the proportion of men with normal posture increased by 31.8 % vs before the experiment and among the men of 41-45-year-old by 17.9 %. Thus, the proportion of men of 36-40 years old with the normal posture who were characterized with the high level of biogeometric posture profile increased by 22.8 % after the experiment and with the medium level – by 9.1 %. On the other hand, the proportion of people with the round back, who had the medium and low biogeometric posture profile before the experiment, decreased by 4.5% and 18.2%, respectively. Comparing the obtained results with the results of ascertaining experiment, it was found that there was a statistically significant increase in both indicators of the biogeometric posture profile in the sagittal and frontal planes of men of 36-40 years old as well as in the overall assessment of their biogeometric posture profile ($p < 0.05$) after the experiment (Table 2).

Table 2. Characteristics of the biogeometric profile of the posture of men 36 - 45 years ($n = 50$), points

Age, years		Frontal plane			Sagittal plane			State of the biogeometric posture profile		
		Terms of the experiment		Δ , %	Terms of the experiment		Δ , %	Terms of the experiment		Δ , %
		before	after		before	after		before	after	
36 – 40, $n=22$	\bar{x}	8.86	10.59	8.88	9.73	11.36	28.21	18.59	21.95	18.09
	S	3.06	2.59		3.30	2.85		6.12	5.26	
	m	0.65	0.55		0.70	0.61		1.31	1.21	
41 – 45, $n=28$	\bar{x}	7.71	9.86	11.29	8.86	10.29	33.33	16.57	20.14	21.55
	S	1.80	2.53		3.08	2.32		4.82	4.75	
	m	0.34	0.48		0.58	0.44		0.91	0.90	

It was determined that the use of the developed technology contributed to the increase of physical fitness of the men in early middle age: it showed the statistically significant ($p < 0.05$) increase in the endurance of the abdominal muscles of the men of both subgroups, and in the group of the men of 36-40 years old this increase was 7.85 %, and in the group of the men of 41-45 years old – 7.83 %. Moreover, after the experiment, we were able to record statistically significant ($p < 0.05$) positive changes in the mobility of the hip joint and lumbar spine in the subgroup of men who participated in the experiment (Table 3).

Table 3. Data of comparative analysis of indicators of physical preparedness of men 36 - 45 years ($n = 50$)

Age, years		Endurance of abdominal muscles, number of times		Difference after vs before the experiment		Mobility of the hip joint and lumbar spine, cm		Difference after vs before the experiment	
		before the experiment	after the experiment	t	p	before the experiment	after the experiment	t	p
36 – 40, $n=22$	\bar{x}	35.91	38.73	7.27	0.001	23.18	25.82	3.28	0.001
	S	9.75	8.71			6.90	5.59		
	m	2.08	1.86			1.47	1.19		
41 – 45, $n=28$	\bar{x}	29.59	31.91	7.22	0.001	18.64	19.68	4.14	0.001
	S	7.50	7.62			3.84	3.58		
	m	1.60	1.62			0.82	0.76		
	t	2.408	2.408			2.697	2.697		
	p	0.020	0.020			0.010	0.010		

The effectiveness of the developed technology has been experimentally confirmed that gave us the grounds to recommend it for the practical implementation in the process of health fitness classes for the men of adulthood.

Discussion

Health of people in early middle age is of particular importance, because this category of the population has the greatest work and life experience, which is of particular value to society as a whole (Andrieieva et al., 2019). In modern living conditions in the absence of significant muscle tension the role of exercise significantly increases, as it is necessary to solve problems of health promotion (Kashuba et al., 2017; Goncharova et al., 2020). Summarizing the views of scientists (Kashuba, Aleshyna & Kolos, 2008; Tkachova et al., 2020) we can state the fact that regular exercise can solve a range of health problems, including strengthening the muscular system, respiratory, cardiovascular and other systems of organism.

The health-improving effect of regular physical exercises with adults has been repeatedly proved in the course of theoretical and experimental studies. The technique of health-recreational beach volleyball with men of mature age in sanatorium conditions was considered in the research of Yarish (2009). A comprehensive method of physical culture and health classes with middle-aged men basing on the integration of football and general physical training was developed by Ghosn (2013). Karpov (2010) proposed a program of classes for middle-aged men basing on the use of strength exercises in a dynamic mode. Yurchuk (2011) considered the impact of cycling aerobics, CrossFit, TRX simulators on the physical condition of men in early middle age. Chernyshova (2012) studied the approaches to the organization of training programs for men of mature age with the use of exercise equipment in a fitness club. Penzai (2014) developed and substantiated a program of preventive and health-oriented classes with the use of table tennis for mature men engaged in mental work. Golovanov (2015) proposed a program for the correction of health of men aged 25-40 years with 1-2 degree obesity and 1A hypertension, using the simulator "Multidoctor" and dietary supplements Trekrezan. Apaychev (2016) substantiated the program of health fitness classes with the use of "Outdoor activity", aimed at correcting the physical condition of men in early middle age. Perevoznikova (2017) substantiated game fitness technology (on the example of basketball), revealed its organizational and methodological, technical and tactical, physical cultural and health characteristics and identified its place in the system of modern fitness.

According to the scientific community (Kashuba & Savlyuk, 2017) one of the factors that negatively affects the functional capabilities of the organism, as well as contributes to the emergence of some chronic diseases, is the age imbalance of the musculoskeletal system which may be manifested by a violation of the level of the biogeometric profile of posture. Numerous studies (Kashuba, Lopatskyi & Lazko, 2017) state that posture violations negatively affect the functions of internal organs, cardiovascular, respiratory and digestive systems and also negatively affect the level of physical and mental performance. According to most authors (Kashuba et al., 2019) posture disorders are one of the most pressing problems of modern society.

Our study gave the further development of knowledge on the regulation of human body's pose (Laputin, Gruzin & Khmel'nitska, 1995) in the way of diagnosis of the state level of the biogeometric profile of men's posture using health fitness classes (Kashuba et al., 2020).

Conclusions

1. The data of the ascertaining experiment identified the level of the state of the biogeometric profile of posture in men 36-40 years was 18.59 ± 6.12 points, and in men 41-45 years – 16.57 ± 4.82 points. The level of biogeometric profile of posture in men 36-40 years was higher than in men 41-45 years old by 14.0% in the frontal plane and by 8.23% in the sagittal one. It was established a statistically significant ($p < 0.05$) effect of the biogeometric profile of the posture of men 36-45 years on the endurance of the abdominal muscles and mobility of the hip joint and lumbar spine.

2. The technology for correction of biogeometric profile of the posture was developed. It was based on the principles of systematization, unity of theory and practice, determinism, health orientation, and its conceptual basis became humanistic, axiological, personality-oriented, activity and technological approaches. The technology consisted of three stages: involving, corrective, supportive and included conceptual, organizational diagnostic components and also the assessment of corrective and preventive measures effectiveness according to certain criteria.

3. As a result of pedagogical experiment the positive changes in posture type were observed namely the proportion of 36-40 years men with normal posture increased by 31.8% and in 41-45 years men by 17.9%. The effectiveness of the proposed technology was confirmed by the results of assessing the level of the biogeometric profile of posture in men of the early middle age. It was found that the state of the biogeometric profile of posture of men 36-45 years aging improved statistically significant in both frontal and sagittal planes after the experiment ($p < 0.05$).

4. It was determined that the use of developed technology contributed to the increase of physical preparedness of men of the early middle age: the endurance of abdominal muscles of men of both subgroups increased statistically significant by 7.85% in men 36-40 years and by 7.83% in men 41-45 years old ($p < 0.05$).

The mobility of men's hip joint and lumbar spine also enforced statistically significant ($p < 0.05$) after the experiment.

Conflicts of interest

The authors have no conflicts of interest.

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