

## Evaluation of the effectiveness of a corrective and rehabilitation program using gravity postisometric relaxation exercises, self-massage and myofascial release on the biogeometric profile of posture and cardiovascular system parameters of women of the second period of mature age

Vitalii Kashuba<sup>a</sup>, Larysa Ruban<sup>a,b</sup>, Pavlo Yefimenko<sup>b</sup>, Oleksii Honcharov<sup>b</sup>, Oksana Kanishcheva<sup>b</sup>

<sup>a</sup>Department of kinesiology and physical culture and sports rehabilitation, National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine

<sup>b</sup>Department of Physical Therapy, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

**Corresponding author:** Larysa Ruban  
e-mail: slarisaruban@gmail.com

### Abstract

**Purpose.** To scientifically substantiate, develop and experimentally verify the impact of a correctional and rehabilitation program using gravitational postisometric relaxation exercises, self-massage and myofascial release on the state of the biogeometric profile of posture and parameters of the cardiovascular system of women in the second period of adulthood.

**Material & Methods.** The 'School of Women's Health' was organized. The total number of 79 people were women aged 36-45 years. The study involved two groups of women with complaints of chronic pain in the cervical spine and fluctuations in the parameters of the cardiovascular system: A group of women aged 36-40 years (n=16) and women aged 41-45 years (n=15). Study procedure: heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured. Posture examination was performed in the frontal and sagittal planes using the REEDCO posture scale. Measurement of the depth of the physiological cervical bend (cervical point) was performed according to the method of Z.P. Kovalkova. With correct posture, the depth of the cervical spine curve is within 5-5.5 cm. Statistical data processing was performed using the statistical package STATISTICA 13.0 (StatSoft).

**Results.** A correctional and rehabilitation programme was developed for the subjects of the 'School of Women's Health', which consisted of three blocks: means of physical culture and sports rehabilitation, psychocorrection, and educational part. In the first block, it was proposed to perform isometric gymnastic exercises aimed at relaxing and strengthening the neck muscles; myofascial release using a massage roll. The aim of the educational component of the programme was to teach women how to perform self-massage of the neck on their own. The research and work on the correctional and rehabilitation programme lasted 3 months. The women spent 21 days in the School of Women's Health under the supervision of a rehabilitation specialist. Subsequently, the women worked independently under the programme, contacting the rehabilitation specialist through online communication in Viber, WhatsApp and Telegram messengers. During the initial communication, all the women complained of recurrent headaches, dizziness, palpitations, and high blood pressure. The results of the formative experiment showed a significant improvement in all parameters of the cardiovascular system ( $p < 0.05$ ). After the implementation of the correctional and rehabilitation programme, the scores on the REEDCO posture scale statistically significantly increased in women aged 36-40 years by 1.04 times ( $p < 0.05$ ), and in women aged 41-45 years by 1.12 times ( $p < 0.05$ ). The introduction of myofascial release into the correctional and rehabilitation programme in women of the second period of mature age had a positive effect on changes in the cervical spine: the depth of spinal curvature according to the method of Z.P. Kovalkova in women aged 36-40 years statistically significantly increased by 1.12 times



( $p < 0.05$ ), in women aged 41-45 years by 1.29 times ( $p < 0.05$ ).

**Conclusions.** Training in the 'School of Women's Health' according to the developed correctional and rehabilitation programme had a positive effect on the parameters of the cardiovascular system, namely, normalization of heart rate, blood pressure, and blood pressure. The use of gravitational post-isometric relaxation, self-massage of the cervical spine, myofascial release significantly improved the biogeometric profile according to the REEDCO posture scale, positively influenced the change in the depth of spinal curvature according to the method of Z.P. Kovalkova.

**Keywords:** biogeometric profile of posture, arterial hypertension, post-isometric relaxation, self-massage, myofascial release.

## Introduction

Due to the urbanisation of the population, the prevalence of chronic back pain, in most cases in the cervical region, and/or arterial hypertension is increasing worldwide. Back in the twentieth century, such problems were most often diagnosed in the elderly, but today they are much younger (Peng et al., 2015; Luhova et al., 2021; Kovalyova et al., 2022; Samoiliuk et al., 2024).

The presence of changes in the biogeometric profile in women in the second period of adulthood provokes the development of arterial hypertension. There is a relationship between the two problems: blood pressure levels depend on the presence and severity of degenerative changes. Insufficient mobility in the joints of the cervical spine leads to headaches, dizziness, and high blood pressure. Due to degenerative changes in the vertebrae, the spinal arteries are compressed, which in turn leads to an increase in pressure; due to the compression of the vertebral vessels, their walls are constantly in tone, which leads to oxygen deprivation, resulting in the development of hypertension (Bruehl et al., 2005; Altaraqji et al., 2020; Ruban et al., 2021).

Peng et al. (2015) hypothesised that vertebral artery insufficiency due to cervical spondylosis may lead to dizziness. However, the mechanisms of dizziness caused by cervical spondylosis are not fully understood. One of the reasons is a decrease in vertebral artery blood flow during head rotation and hyperextension. The second reason indicates that hypertension may be associated with cervical spondylosis as a secondary disease. Due to the fact that degenerative discs are always inflammatory discs, that is, degeneration is always accompanied by pain. Blood pressure levels, even at rest, can be elevated with persistent pain in the cervical spine (Peng et al., 2015).

A retrospective study by Bruehl et al. (2005) showed that chronic pain may be associated with an increased risk of developing hypertension. The authors proved that in patients with chronic spinal pain, over time, a higher prevalence of clinically diagnosed hypertension will result in a higher prevalence of hypertension compared to patients

without pain (Bruehl et al., 2005). Our study suggests a possible link between reduced spinal curvature in the cervical spine and hypertension. If chronic pain in the cervical spine is reduced by decreasing spinal curvature, it can lead to hypertension due to sympathetic arousal and failure of normal homeostatic mechanisms of pain regulation. At the same time, early rehabilitation intervention followed by post-isometric relaxation exercises (Honcharov et al., 2020) and independent performance of myofascial release techniques can have a beneficial effect on restoring spinal curvature in the cervical spine and reducing the risk of developing hypertension in women of the second period of adulthood.

A generalized analysis of the scientific literature shows that, despite the close attention of specialists to the comorbidity of chronic spinal pain with arterial hypertension, the issue of correction of biogeometric posture profile disorders in women of the second period of adulthood with recurrent high blood pressure is not covered.

*Purpose* – to scientifically substantiate, develop and experimentally test the effect of a correctional and preventive programme using gravitational post-isometric relaxation exercises, self-massage and myofascial release on the state of the biogeometric posture profile and parameters of cardiovascular system assessment in women of the second period of mature age.

## Material and methods

### *Participants*

The 'School of Women's Health' was organized based on the State Enterprise 'Clinical Sanatorium "Roshcha" of the Ukrprofozdorovnytsia. The total number of participants was 79 women aged 36-45 years. The study involved two groups of women with complaints of chronic pain in the cervical spine and fluctuations in cardiovascular parameters: A group of women aged 36-40 years ( $n=16$ ) and a group of women aged 41-45 years ( $n=15$ ). The study was conducted in compliance with all relevant national regulations and institutional policies, the principles of the Declaration of Helsinki adopted by the General Assembly of

the World Medical Association (1964-2000), the Council of Europe Convention on Human Rights and Biomedicine (1997).

#### *Procedure*

Study procedure: heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured. Posture examination was performed in the frontal and sagittal planes using the REEDCO posture scale. The scale consists of 10 items, according to which posture must be assessed from 0 to 10 points for each item. The total score on the REEDCO posture scale ranges from 0 to 100 points. The higher the score, the better the posture (Ruban et al., 2021).

Measurement of the depth of the physiological cervical bend (cervical point) was performed according to the method of Z.P. Kovalkova. With correct posture, the depth of the cervical spine curve is in the range of 5-5.5 cm (Ruban et al., 2021).

#### *Statistical analysis*

Statistical data processing was performed using the statistical package STATISTICA 13.0 (StatSoft). The arithmetic mean –  $\bar{X}$ ; standard deviation –  $\delta$ ; variance –  $D$ ; error of the arithmetic mean –  $\pm m$ . To determine significant differences, the parametric Student's test was used; differences at  $p < 0.05$  were considered statistically significant.

## **Results**

A correctional and rehabilitation programme was developed for the subjects of the 'School of Women's Health', which consisted of three blocks: means of physical culture and sports rehabilitation, psychocorrection, and educational part. In the first block, it was proposed to perform isometric gymnastic exercises aimed at relaxing and strengthening the neck muscles; myofascial release using a massage roll. The educational component of the programme aimed to teach women how to perform self-massage of the neck on their own.

The research and work on the correctional and rehabilitation programme lasted 3 months. The women spent 21 days in the School of Women's Health under the supervision of a rehabilitation specialist. Later, the women worked independently under the programme, and kept in touch with the rehabilitation specialist through online communication in Viber, WhatsApp and Telegram messengers.

*Neck self-massage technique:* sitting on the edge of a chair, back straight. *Gravitational post-isometric relaxation (GPR)* of the neck muscles. Starting position – sitting on a chair, torso slightly forward, head down and in a state of extension. Take a deep breath to the count of 1-4, relax the

neck muscles as much as possible. Slowly exhale through the lips, which are closed for a count of 5-12. A sign of correct performance of this exercise is a noticeable increase in the forward tilt of the head. The number of repetitions is no more than 3-4 times.

*Self-massage of the neck.* The starting position is sitting on a chair, resting your back against the back of the chair, head back by 200. Using the pads of the fingers of both hands, knead the paravertebral muscles simultaneously on both sides of the spinous processes in a circular and spiral motion. Next, rub the attachment points of the cervical muscle tendons on the base of the back of the head with the thumbs, working out the occipital tubercles in a circular motion, for 5-7 minutes.

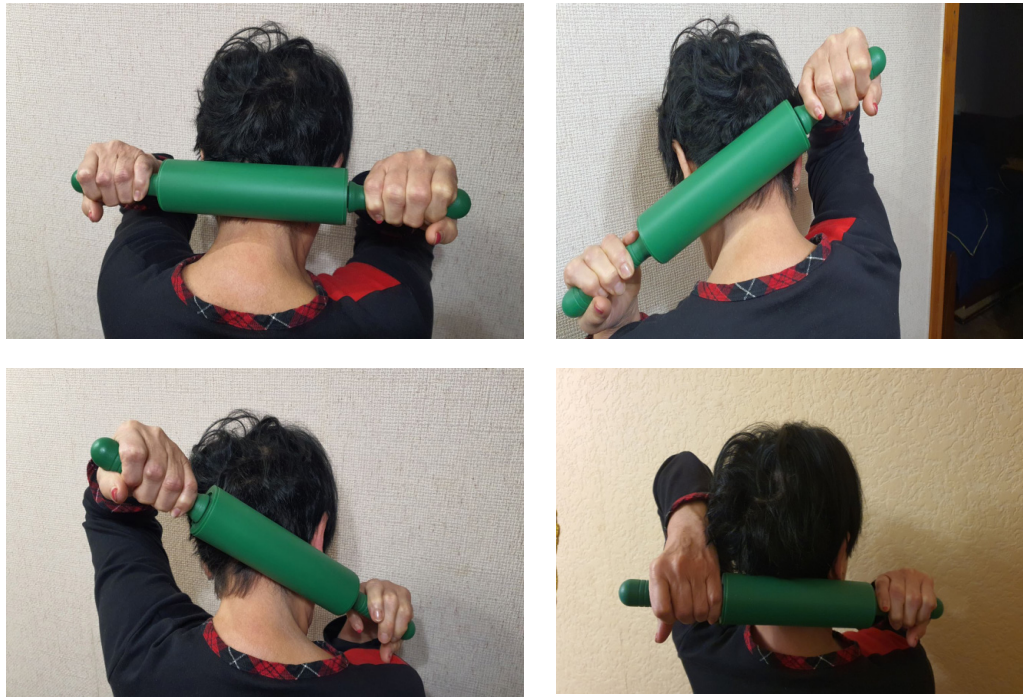
*Myofascial release* was performed using a manual massage roll. Starting position – standing or sitting on a chair, head tilted forward, neck muscles relaxed as much as possible, all muscle tissues tensioned along the posterior surface under the weight of the head. With both hands, we hold the massage roll by the handles, which makes it possible to lower the roll as low as possible. Alternately roll the massage roll over the neck muscles on both sides, 15-20 times. Next, use the massage roll to work out the attachment points of the neck muscle tendons along the entire length of the base of the back of the head, for 3-5 minutes (Fig. 1).

At the end of the *self-massage procedure*, the *stretching of subcutaneous tensions* was performed by pulling the skin on the surface of the back of the head. Grasp the hair with the fingers of both hands and make a fist. Then, without releasing the hair, perform 3-4 circular movements in both directions. A sign that this exercise has been performed correctly is a feeling of warmth in the back of the head.

After the exercises and self-massage, the women wore the Chance collar for 1-2 hours, which helps to maintain the effect of the exercises and massage.

During the initial interview, all women complained of recurrent headaches, dizziness, palpitations, and an increase in blood pressure up to 135-140/85-90 mmHg (Table 1).

After the implementation of the correctional and rehabilitation programme, a formative experiment was conducted. Women of both groups had no complaints of headaches and high blood pressure. Thus, in women aged 36-40 years, the heart rate parameter tended to decrease significantly ( $p > 0.05$ ); the BPC parameter statistically significantly decreased by 0.93 times ( $p < 0.05$ ) compared to the initial one; the BPD parameter statistically significantly decreased by 0.93 times ( $p < 0.05$ ) compared to the initial one. Women aged 41-45 years showed statistically significant



**Fig. 1.** An example of the myofascial release technique.

**Table 1.** Features of cardiovascular system parameters in women aged 36-40 years (n=16) and women aged 41-45 years (n=15)

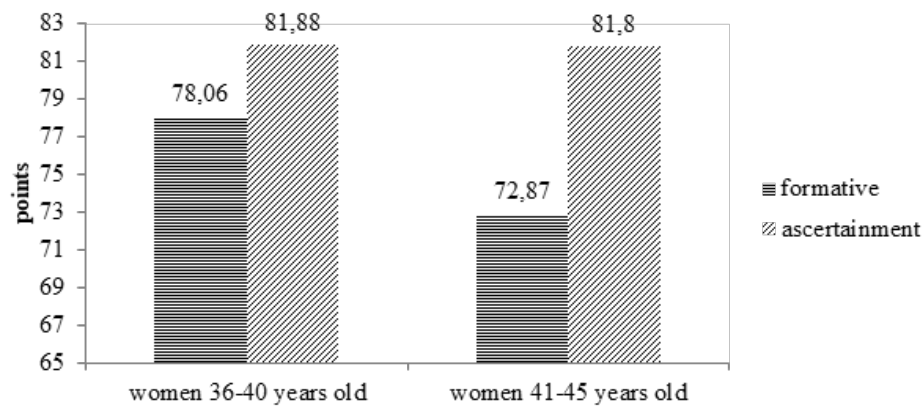
CVS parameters	Women aged 36-40 (n=36)		Women aged 41-45 (n=43)	
	before the programme X±m	after the programme X±m	before the programme X±m	after the programme X±m
Heart rate, post. per min	73,18±1,74	69,68±0,97	74,46±1,59	69,93±1,01
	t=1,76; p>0,05		t=2,40; p<0,05	
SBP, mmHg	131,31±1,22	122,51±1,37	134,33±1,48	122,66±1,45
	t=4,80; p<0,05		t=5,63; p<0,05	
DBP, mmHg	76,87±1,57	72,18±1,01	79,33±1,45	72,06±1,06
	t=2,51; p<0,05		t=4,05; p<0,05	

improvement in all parameters: Heart rate decreased by 0.94 times ( $p<0.05$ ); BPC decreased by 0.91 times ( $p<0.05$ ); and DBP decreased by 0.90 times ( $p<0.05$ ).

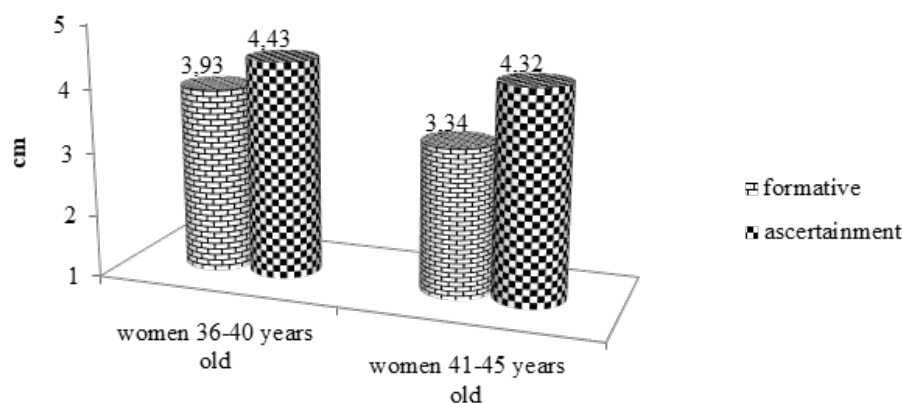
In women of both groups of the second period of mature age, after three months of work under the correctional and rehabilitation programme, there were observed changes in the biogeometric profile according to the REEDCO posture scale. Thus, in women aged 36-40 years, the primary indicators were within  $78.06\pm 1.34$  points out of 100 points according to the norm. In the initial measurements, the indicators of the biogeometric profile in women aged 41-45 years were  $72.87\pm 1.05$  points. That is, it can be argued that negative changes in posture occur over the years. The results of the formative experiment indicated a positive impact of the programme on women's posture (Fig. 2).

After the implementation of the correctional and rehabilitation programme, the REEDCO posture scale scores statistically significantly increased in women aged 36-40 years by 1.04 times ( $p<0.05$ ), in women aged 41-45 years by 1.12 times ( $p<0.05$ ).

With correct posture, the depth of spinal curves in the cervical spine is within 5-5.5 cm. In women of the second period of adulthood, the variation in the cervical spine ranged from 3 cm to 4 cm. That is, according to the method of Z.P. Kovalkova, a tendency to straighten physiological lordosis in the cervical spine was observed. Reducing the curvature of the spine in the cervical spine reduces the shock absorption capacity and provokes fluctuations in blood pressure. The introduction of myofascial release into the correctional and rehabilitation programme in women of the second period of mature age had a posi-



**Fig. 2.** Changes in the biogeometric profile of posture according to the REEDCO scale in women aged 36-40 years and women aged 41-45 years under the influence of a correctional and rehabilitation programme.



**Fig. 3.** Changes in the depth of spinal curvature according to the method of Z.P. Kovalkova in women aged 36-40 years and women aged 41-45 years under the influence of a correctional and rehabilitation programme.

tive effect on changes in the cervical spine: the depth of spinal curvature according to the method of Z.P. Kovalkova in women aged 36-40 years statistically significantly increased by 1.12 times ( $p < 0.05$ ), in women aged 41-45 years by 1.29 times ( $p < 0.05$ ) (Fig. 3).

## Discussion

Chronic spinal pain is a progressive disease with periods of remission and exacerbations, which causes severe neurological and orthopaedic disorders. Luhova & Tymchyk (2021) note that the problem is particularly relevant, according to medical statistics, about 50% of the population has pathology in the cervical spine. It is believed that physical rehabilitation methods can increase the effectiveness of basic drug therapy, including isometric exercises, post-isometric muscle relaxation, proprioceptive neuromuscular perception, postural exercises and special massage. We support the authors' opinion that the development of wellness programmes correlates with the diagnosis of spinal biomechanics, understanding of the main means and methods of rehabilitation for cervical osteochondrosis.

A literature review by Kovaleva et al. (2022) systematised the available information on the etiology and pathogenesis of fibromyalgia, as well as the classification and causes of hypertension, and considered possible links between these two pathologies. The authors identified the main areas of fibromyalgia research and evaluated further prospective studies of the relationship between fibromyalgia and hypertension.

Ruban (2021) noted that one of the most important conditions for postural disorders is relative muscle weakness in some parts of the musculoskeletal system, which manifests itself as a result of heavy loads. The results of our study confirmed previous research.

Based on their's study's results, Hulens et al. (2018) discussed possible pathophysiological links between idiopathic intracranial hypertension, fibromyalgia, and chronic fatigue syndrome. Our study's results of support the hypothesis (Al-taraqji et al., 2020) that chronic headache in fibromyalgia may be a manifestation of idiopathic intracranial hypertension.

Kashuba et al. (2019) found that with age there is an increase in the number of postural

disorders in men of the first period of adulthood. Timely detection and differentiation of changes in the spatial organisation of the human body will allow to plan corrective and preventive health measures. To this end, it is necessary to conduct an express assessment of the musculoskeletal system by indicators of the state of the biogeometric profile of posture in the frontal and sagittal planes, as well as by the indicator of the generalized total assessment of its biogeometric profile.

Samoiliuk et al. (2024) found that the most common type of posture among women in the first period of adulthood is the round back type, which is found in 44.4% of women, while normal posture and scoliotic posture occur with the same frequency of 27.8% each. To summarise, normal posture was found to be associated with health-promoting habits in women in the first period of adulthood. Impaired posture, regardless of the type of impairment, was marked by a lower frequency of morning gymnastic exercises and a lower habit of doing gymnastics between work. When it comes to the motives for health fitness classes, according to the data from the total sample, the most important for women was health improvement with an average ranked value of 1.44. It was in the first place for 72.2% of the respondents. Aesthetic appearance was also an important motivator, with an average rank of 1.97, and 22.2% of women considered it the main fitness's goal.

Honcharov et al. (2020) concluded that one of the tasks of kinesiotherapy in the training motor regime is to facilitate the functional recovery of patients with chronic back pain. The main means of kinesiotherapy is exercise. When selecting physical exercises, it should be borne in mind that they should not only improve blood and lymph circulation in the spinal segment, but also reduce the emotional stress of athletes with chronic pain. The use of post-isometric relaxation is the main feature of relieving paravertebral muscle tension in vertebrogenic reflex syndromes. The results of our study confirmed the conclusions of the authors regarding the use of gravitational post-isometric relaxation.

## Conclusions

The study suggests that women in the second period of adulthood have changes in the biogeometric profile of posture and fluctuations in the parameters of the cardiovascular system. Classes at the 'School of Women's Health' according to the developed correctional and rehabilitation programme had a positive effect on the parameters of the cardiovascular system, namely, normalisation of heart rate, blood pressure, and blood pressure. The use of gravitational post-isometric relaxation, self-massage of the cervical spine, myofascial re-

lease significantly improved the biogeometric profile according to the REEDCO posture scale: statistically significant increase in women aged 36-40 years by 1.04 times ( $p < 0.05$ ), in women aged 41-45 years by 1.12 times ( $p < 0.05$ ). The change was also positively influenced by the depth of spinal curvature according to the method of Z.P. Kovalkova, namely, in women aged 36-40 years it statistically significantly increased by 1.12 times ( $p < 0.05$ ), in women aged 41-45 years by 1.29 times ( $p < 0.05$ ).

*Prospects for further research* are related to the study of the impact of the correctional and rehabilitation programme on the adaptive potential of the subjects of the 'School of Women's Health'.

## References

- Altaraqji, S., Terkawi, R.S., Ali, A., Al-Shami, R., & Mohamed, K. (2020). Arterial ischemic stroke in a child with isolated small internal carotid artery: A Case Report and Literature Review. *Ann Case Report*, 14, 484. <https://bit.ly/4boWoRt>
- Bruehl, Stephen, Chung, Ok Yung, Jirjis, James N. & Biridepalli, Sujatha (2005). Prevalence of clinical hypertension in patients with chronic pain compared to nonpain general medical patients. *The Clinical Journal of Pain* 21(2). P. 147-153. <https://bit.ly/4kk6kzV>
- Byshevets, N., Kashuba, V., Levandovska, L., Grygus, I., Bychuk, I., Berezhanskyi, O., & Savliuk, S. (2022). Risk factors for posture disorders of esportsmen and master degree students of physical education and sports in the specialty «Esports». *Sport i Turystyka. Środkowoeuropejskie Czasopismo Naukowe*, 5(4), 97-118. <https://doi.org/10.16926/sit.2022.04.06>
- Honcharov, A., Ruban, L., Litovchenko A., Okun, D., & Turchinov, A. (2020). Physical therapy for old-timer athletes with chronic back pain. *Physiotherapy Quarterly*, 28(2), 20-24. <https://doi.org/10.5114/%20pq.2020.92475>
- Kashuba, V., Radchenko, A., Radchenko, Y., Vako, I., & Usychenko, V. (2024). The state of the biogeometric profile of the posture of young athletes specializing in hand-to-hand combat as a prerequisite for the development of corrective and preventive measures. *Physical rehabilitation and recreational health technologies*, 9(4), 224-237. [https://doi.org/10.15391/prrht.2024-9\(4\).03](https://doi.org/10.15391/prrht.2024-9(4).03)
- Kashuba, V.O., Rudenko, Y.V., Khabinets, T.O., Vatamaniuk, S.V., & Danilchenko, V.A. (2019). Effectiveness of the technology of correction of biogeometric posture profile disorders in mature men in the process of health fitness training. *Scientific Journal of the Drahomanov National Pedagogical University*, 11(93), 94-100. <https://doi.org/10.15330/fcult.1.59-68>
- Kovalyova, O., Kovaleva, A., & Khudetsky, I. (2022).

- Possible relations between arterial hypertension and cervical spine fibromyalgias (literature review). *Ukrainian Scientific Medical Youth Journal*, 2(131), 85-94. [https://doi.org/10.32345/USMJ.2\(131\).2022.85-94](https://doi.org/10.32345/USMJ.2(131).2022.85-94)
- Lopatskyi, S.V., & Maslova, O.V. (2024). Reculiarities of somatometric indices of young basketball players with different types of posture. *Rehabilitation & Recreation*, 18(1), 190-202. <https://doi.org/10.32782/2522-1795.2024.18.20>
- Luhova, B., & Tymchyk, O. (2021). Physical therapy of elderly people with cervical spine osteochondrosis in a rehabilitation centre. *Physical education, sports and human health: experience, problems, prospects (in the cycle of Anokhin readings): materials of the IX All-Ukrainian scientific and practical online conference*, 318-324. <http://sporthealth.kubg.edu.ua/>
- Peng, B., Pang, X., Li, D., & Yang, H. (2015). Cervical spondylosis and hypertension: a clinical study of 2 cases. *Medicine*, 94(10), e618. <https://doi.org/10.1097/md.0000000000000618>
- Ruban, L., Vlasko, S., Goncharov, O., Litovchenko, A., & Piven, O. (2021). Evaluation of the biogeometric profile of the musculoskeletal system in armwrestlers. *Scientific Journal of the Mykhailo Drahomanov Ukrainian State University, Series 15*, (4(134), 94-98. [https://doi.org/10.31392/NPU-nc.series15.2021.4\(134\).23](https://doi.org/10.31392/NPU-nc.series15.2021.4(134).23)
- Samoiliuk, O.V., Bychuk, A.I., & Grigus, I.M. (2024). Assessment of lifestyle and motivation for health fitness of women of the first period of mature age using the method of building a decision tree. *Rehabilitation & Recreation*, 18(4), 128-141. <https://doi.org/10.32782/2522-1795.2024.18.4.13>
- Sports of Ukraine, Kyiv, Ukraine.
- Larysa Ruban**  
<https://orcid.org/0000-0002-7192-0694>,  
Department of kinesiology and physical culture and sports rehabilitation, National University of Physical Education and Sports of Ukraine, Kyiv, Ukraine.  
Department of Physical Therapy, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine.
- Pavlo Yefimenko**  
<https://orcid.org/0000-0003-4674-6919>,  
Department of Physical Therapy, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine.
- Oleksii Honcharov**  
<https://orcid.org/0009-0000-4659-8819>,  
Department of Physical Therapy, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine.
- Oksana Kanishcheva**  
<https://orcid.org/0000-0002-5030-5318>,  
Department of Physical Therapy, Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine.
- Author's contribution**  
Conceptualization, V.K. and L.R.; methodology, L.R. and P.Y.; software, O.K.; check, L.R. and P.Y.; formal analysis, V.K.; investigation, O.G.; resources, O.K.; data curation, O.K.; writing - rough preparation, O.G.; writing - review and editing, V.K. and L.R.; visualization, O.G.; supervision, L.R.; project administration, L.R. All authors have read and agreed with the published version of the manuscript.

## Supplementary Information

### Article details

The online version available at  
[https://doi.org/10.15391/prrht.2025-10\(1\).03](https://doi.org/10.15391/prrht.2025-10(1).03)

### Conflict of interest

The authors declare that there is no conflict of interest.

### Funding Statement

This article did not receive financial support from the state, public or commercial organizations.

**Received: January 12, 2025; Accepted: February 15, 2025**

**Published: February 28, 2025**

### Authors details

#### Vitalii Kashuba

<https://orcid.org/0000-0001-6669-738X>,  
Department of kinesiology and physical culture and sports rehabilitation, National University of Physical Education and