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EDITORIAL ARTICLE

Physical management in algodystrophy syndrome

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ABSTRACT

Aim: Complex regional pain syndrome (CRPS) is characterised by chronic pain, swelling, and vasomotor dysfunction. The disorder often gradually leads to muscle dystrophy, bone defects, and decreased limb function. The etiology of this condition has not been fully established. Aim. To analyse the physical therapy in CRPS patients treated at the Division of Physical Medicine of the Department of Rehabilitation in 2012-2022.

Materials and Methods: The study involved a group of 58 patients after distal epiphyseal fractures of the forearm and crus. Testing concerned the following: hand or foot skin temperature, hand grip strength, pain intensity, bone radiographs, and psychosomatic profile according to Zung's scale. Physical therapy included whirlpool massage, lidocaine and calcium iontophoresis, variable low frequency magnetic fields, and kinesiotherapy.

Results: After 6-week treatment, we achieved full clinical improvement in 82% of the patients and partial improvement in 18% (these were patients in whom the treatment was introduced at an advanced stage of the disorder).

Conclusions: 1. Complex regional pain syndrome is a difficult clinical problem. 2. Early diagnosis and introduction of focused physical therapy allow for full restoration of limb function.

KEY WORDS: complex regional pain syndrome, physical therapy

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INTRODUCTION

Complex regional pain syndrome (CRPS) is characterised by chronic pain, swelling, and vasomotor dysfunction. Untreated CRPS gradually leads to muscle dystrophy, bone defects, and decreased function of the affected limbs. It has been known by many names, including Sudeck's atrophy and reflex sympathetic dystrophy [1-6]. The aetiology of CRPS has not been established. It is believed to result from abnormal activity of the sympathetic nervous system. Presumably, the abnormal responsiveness leads to increased sensitivity of the affected axons to norepinephrine and other substances released by the sympathetic nerves [5-15].

The syndrome develops usually after fractures, joint injury, contusion, frostbites, burns, and neural damage. CRPS may develop under ischaemic heart disease or following myocardial infarction or stroke (so-called paralytic CRPS). Other risk factors include inflammatory skin diseases, hormonal disturbances, and the use of certain drugs (barbiturates, antitubercular drugs, cyclosporin A) [15-20].

CRPS develops in three stages:

Stage I (hypertonic) lasts between 3 weeks and 2 months. Main symptoms include pain, swelling, skin redness, increased skin warmth, and sweating caused by the constriction of arterioles and dilation of arteriovenous capillaries as well as active hyperaemia.

Stage II (dystrophic) lasts between 6 weeks and 4 months. Symptoms include chronic pain, cyanosis, atrophic skin lesions, lower skin temperature, and stiffness of the affected joints; radiography reveals patchy bone loss. There is atrophy of muscles and subcutaneous tissue and the nails become brittle. Active hyperaemia is replaced by passive hyperaemia associated with flaccid arterioles and capillaries.

Stage III (atrophic) lasts between 6 and 12 months. The skin is shiny, increasing tendon shortening combined with fibrosis of the fascia and articular capsules leads to limb dysfunction, the pain decreases, and muscle atrophy develops further [21-24].

Physical therapy is the basic part of the treatment of complex regional pain syndrome [24-30].

AIM

To analyse the physical therapy in patients treated at the Division of Physical Medicine of the Department of Rehabilitation in 2012-2022.

MATERIALS AND METHODS

The study involved a group of 58 patients aged 49-76 years after distal epiphyseal fractures of the forearm and crus and with evidence of complex regional pain syndrome.

Testing included:

- hand or foot skin temperature,
- circulation assessment,
- hand grip strength,
- pain intensity (VAS),
- radiographs of the forearm, hand, or foot,
- psychosomatic profile according to Zung's scale.

The patients were examined prior to and after 6-week treatment.

Physical therapy included the following:
- whirlpool massage of upper or lower limbs,
- lidocaine and calcium iontophoresis,
- variable low frequency magnetic field (sinusoidal, bipolar, frequency 30 Hz, field induction 3 mT).

Kinesiotherapy included:
- passive-active exercises,
- manual exercises,
- exercises improving grip strength, self-assisted exercises.

Clinical presentation (Fig. 1A, Fig. 1B) and radiographic appearance (Fig. 2) of the patients:

RESULTS

The statistical analysis of the study group was performed using standard parameters: mean, median, and standard deviation. It was verified with Student's t test for data collected prior to and after treatment. The significance level was set at $p<0.05$. The analysis showed a significant positive correlation for posttherapeutic improvement as compared to baseline results.

The statistical analysis confirmed a significantly advantageous effect of physical therapy on the subjective and objective assessment of the patients. The blood supply returned to normal, the range of mobility was increased, the hand grip strength improved considerably, and the pain was eliminated or significantly decreased. The psychosomatic status of the patients was markedly improved.

The treatment resulted in full clinical improvement in 49 patients; the improvement observed in the other 9 patients was partially due to the fact that these were patients in whom the treatment was introduced at an advanced Stage II of the disorder (Table 1-4).

The comparison shows that Zung's score significantly decreased after treatment. On average, the score was lower by 7 and decreased by more than 6 points in 50% of the patients. Fig. 3 present thermal images of the lower leg of the patient whose radiograph is shown in Fig. 2B.

DISCUSSION

Complex regional pain syndrome gradually leads to muscle atrophy, patchy bone loss and joint stiffness. Its symptoms include idiopathic pain, pain on palpation, local circulatory disturbances and excessive sweating which result from the abnormal activity of the sympathetic nervous system. The activity of neurovegetative regulators is disturbed and vessel wall tension changes, causing vasodilation or vasoconstriction (various forms of the syndrome are sometimes called 'white' or 'blue'). Ischaemia and hypoxia of the tissues result in swelling and acidosis, leading to patchy bone density (calcium) loss. The mechanical theory explains CRPS as a result of passive hyperaemia after injury, associated with decreased blood supply caused by the lack of limb movement, usually after immobilization. The disorder develops in three stages which are not clearly distinguished. The syndrome may stop at

A.

B.

Fig. 1. A. Clinical presentation of changes within the hand; B. Clinical picture of changes in lower leg.

A.

B.

Fig. 2. A. Radiograph of changes in the hand. B. Radiograph of lower limbs with significantly disturbed bone calcification in the ankle joint on the left.

Table 1. Skin temperature assessment

	Affected limb Mean values + standard deviation	Unaffected limb Mean values + standard deviation
Before treatment	35.3°C (+/- 0.5°C)	36.5°C (+/- 0.3°C)
After treatment	36.4°C (+/- 0.3°C)	36.5°C (+/- 0.3°C)

Table 2. Hand grip strength assessment

	Affected hand Mean values + standard deviation	Unaffected hand Mean values + standard deviation
Before treatment	11mm/Hg (+/-5mm/Hg)	45mm/Hg (+/-10mm/Hg)
After treatment	33mm/Hg (+/-5mm/Hg)	45mmHg (+/-10mm/Hg)

Table 3. Pain intensity (VAS)

Before treatment Mean values + standard deviation	After treatment Mean values + standard deviation
8.4 (+/- 1.6)	4.1 (+/- 2.1)

Table 4. Comparison of scores according to Zung's anxiety scale before and after treatment

	Mean and standard deviation study group	
Zung's score before treatment	42.6	1.7
Zung's score after treatment	35.6	1.6
Decrease in Zung's score	7	0.8

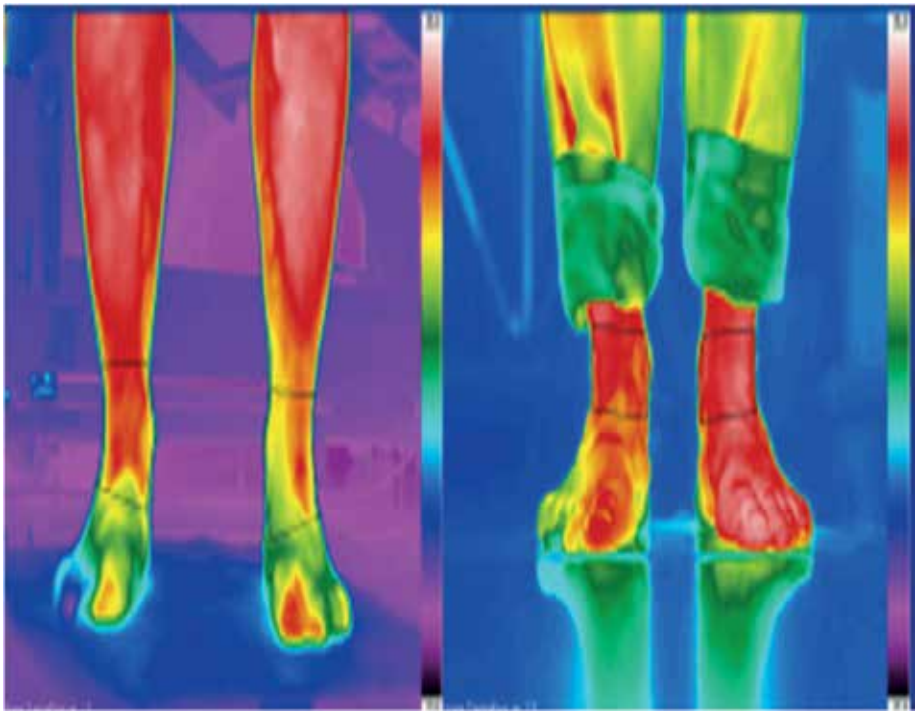

Fig. 3. Thermal image of the patient's foot on admission; there is a difference in temperature of 5.4 degrees Celsius.

the first or second stage; once the patient reaches the third stage, the return to normal function is impossible.

In Stage I, intensive pain may be treated with careful application of nitrogen vapour; active exercises should be avoided as they may increase swelling. The patient underwent whirlpool massage and lidocaine and calcium iontophoresis. Variable low frequency magnetic fields are used every day for 3 weeks and then every other day. We recommend positional therapy as well as passive and passive-active exercises performed at home. The use of alpha-blockers and calcitonin is taken into consideration.

In Stage II, when the skin is cold and damp, the nails become rigid and brittle, there is hair loss on the affected body part and the patient suffers from contracture and increased muscle atrophy, we continue treatment with whirlpool massage, brush massage, lidocaine and calcium iontophoresis and magnetronic, introduce laser biostimulation, add new passive-active exercises and continue the administration of alpha-blockers and calcitonin.

In Stage III, as muscle atrophy and joint stiffness increase, we use lidocaine and calcium iontophoresis, magnetronic, laser therapy, introduce ultrasound and supplement kinesiotherapy with assisted exercise and passive stretching. The pharmacological treatment continues.

Complex regional pain syndrome type I is a condition whose pathomechanism has not been fully understood yet; consequently, new treatment methods should be sought [21]. Main symptoms consist in impaired function of the autonomic nervous system: patients experience limb pain and swelling, vasomotor disturbances, and increased sensitivity to pressure and temperature changes. In the treatment of Stages I and II it is useful to consider the introduction of physical therapy improving the blood supply and changing the reactivity of the autonomic nervous system, such as water jets at alternating temperatures and hyperbaric oxygen therapy [22-25].

Water jets are used in this condition due to their multidimensional stimulation of the body, consisting in mechanical, thermal, and hydrostatic effects of water on the skin, which lead to numerous reactions of the body [26-29].

Beneficial effects of water jets at alternating temperatures observed in the treatment of functional cardiovascular

disorders justify their use in complex regional pain syndrome type I. A study conducted at the Department of Rehabilitation of the Military Medical Institute in Warsaw [29] used non-invasive diagnostic methods to assess autonomic nervous system function, including an analysis of sinus rhythm variability, and showed a statistically significant increase in HF, r-MSSD and pNN50 after a series of procedures using water jets at alternating temperatures, which reflected a broader spectrum of high frequencies and normal circulatory system function. The body's response to thermal and hydrodynamic stimuli depends on the condition of the skin and the autonomic nervous system. There is mutual inhibition among neurons consisting in the modulation of final mediator release in sympathetic and parasympathetic postganglionic neurons. Consequently, one can expect beneficial effects of water jet at alternating temperatures in complex regional pain syndrome type I.

They patients may also benefit from hyperbaric oxygen therapy as it improves oxygen supply to the damaged part of the limb, increases blood supply, reduces tissue swelling, and activates neoangiogenesis. This treatment also allows for reducing endothelial damage through decreasing the ability of neutrophils to adhere to vessel walls. Increased oxygen levels within the limb help reduce its swelling and improve the efficacy of circulation [30]. Hyperbaric oxygen therapy should be introduced as early as possible.

One should always remember that the treatment of complex regional pain syndrome requires a lot of patience and time on the part of both the patient and doctor. The most important part of Sudeck's posttraumatic bone dystrophy prevention is to eliminate painful and pathological stimuli. It is achieved through appropriate limb immobilization, correct reduction and fragment fixation in the case of a fracture. The recently popular so-called stable osteosynthesis (AO) has reduced the incidence of CRPS to a minimum. This method allows for active movement as early as several days after surgical fracture reduction and does not require plaster cast immobilization. An important part of CRPS prevention is correct, high positioning of the limb, especially in the case of large haematomas. This improves circulation and local metabolism.

In the first stage, complex regional pain syndrome may resemble articular tuberculosis. The syndrome should also be distinguished from RA inflammation, hormonal changes in the bones and other disorders.

The prognosis of complex regional pain syndrome depends on the severity and location of the process as well as the time of treatment introduction. Usually, the course of the disorder within the foot is successful. If changes develop within the fingers, wrists, knee or shoulders and the treatment is inappropriate or too late, a chronic process often develops, resulting in various degrees of joint mobility limitation. Patients in whom physical therapy and rehabilitation began late suffer from persistent muscle atrophy and joint stiffness.

CONCLUSIONS

1. Complex regional pain syndrome is a difficult diagnostic and clinical problem.

2. Early diagnosis and introduction of focused physical therapy and rehabilitation allow for full restoration of limb function.

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The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Use of low-frequency laser and magnetotherapy treatments in women with lumbosacral pain complaints

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ABSTRACT

Aim: The aim of this study was to compare and evaluate the effectiveness of physical therapy in the treatment of pain associated with degenerative changes of the lumbosacral spine.

Materials and Methods: Twenty-five women diagnosed with degenerative disease of the lumbosacral spine participated in the study. The patients were divided into two study groups and one group was assigned laser therapy treatments and the other group was assigned low frequency magnetotherapy treatments. Pain levels were tested using a numerical scale and disability levels were assessed using a standardised Roland-Moriss questionnaire.

Results: In the group of women in which the laser therapy treatment was performed, the scatter plot of the two variables DQRM-Laser therapy_1 (assessed questionnaire before the laser therapy treatments) and DQRM-Laser therapy_2 (assessed questionnaire after the completed magnetotherapy treatments) shows lower values after the completed series of laser therapy treatments .The score represents the sum of the marked answers to the questions, the greater the sum of the scores the greater the degree of impaired performance .There are four degrees of quality of life impairment: none/slight – 0-3 points, medium – 4-10 points, large – 11-17 points, very large – 18-24 points.

Conclusions: The study showed that both study groups had reduced levels of pain and obtained reduced Roland-Moriss questionnaire values. There was a significant statistical difference for the reduction of pain sensations in the lumbosacral spine.

KEY WORDS: magnetotherapy, laser therapy, lumbo-sacral pain, women

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INTRODUCTION

The vertebral column supports the entire body, supports the body's weight and provides balance, absorbs shock and protects the spinal cord and spinal nerves [1]. After the age of 50, the intervertebral discs begin to flatten and the curvatures deepen. The spine is an organ of movement and has mobility in all planes [1]. Spinal pain of specific and non-specific nature is a common complaint in humans, especially in the elderly [2-4]. The most common cause of spinal pain is its degenerative changes [5]. Degenerative changes are divided into primary and secondary. In the case of primary degenerative changes, genetic predisposition is indicated [6], with approximately 50% to as much as 75% of intervertebral disc degradation having a direct genetic basis [7]. Secondary degenerative changes arise as a result of the consequences of many years of joint overload due to, for example, obesity or overweight patients, physical work involving heavy loads or repetition of a particular movement, and in people who train competitively [8]. It is not only excessive movement that causes the development of degenerative changes, but also the lack of movement [6, 8]. Trauma is also a factor that predisposes to the appearance of degenerative changes, which can result in fractures, bony displacements, micro-injuries, as well as crushing and deformation of articular cartilage [9]. A lack of vitamin D in the body can also affect the development of degenerative changes [10]. Excessive amounts of chemicals and minerals can disrupt functions at the cellular level. It is also important to take care of the proper requirement of vitamins A, E and C, i.e. antioxidants, the deficiency of which causes the formation of oxygen free radicals. Inadequate vitamin D as well as the above-mentioned vitamins promote the development of degenerative changes [10].

The main symptom of non-specific and specific low back pain is the experience of pain [11]. The pain can be acute and chronic [11]. The pain can also be radiating to the lower limbs, worsening with prolonged standing or walking. Patients may experience stiffness in the lumbar spine in the morning. In addition, paresthesias and reduced spinal mobility may occur [12]. Degenerative changes also affect the soft tissues causing enthesopathy, which is characterised by enthesophytes located at muscle and ligament attachments [13]. Osteophytes located at the edges of the joints or vertebral bodies can compress the

meningeal sac, nerves or spinal cord [14]. Syndesmophytes stiffen the spine while connecting the vertebrae together [14], and thickening of the yellow ligaments, which are also one of the walls of the spinal canal, causes narrowing of the spinal canal [14]. Treatment of spinal pain is difficult, requiring the patient to be systematic. Treatment includes pharmacology, exercise [15] and physical medicine treatments [16].

AIM

In order to test the effectiveness of the treatments, a research hypothesis was adopted: low-frequency magnetotherapy treatments and laser therapy treatments influence the reduction of pain sensations in the lumbosacral spine and influence the reduction of disability in women over 60 years of age. The aim of the study was to verify the research hypothesis.

MATERIALS AND METHODS

The study was conducted in a group of economically inactive (retired) women with a diagnosis of lumbosacral osteoarthritis. Twenty-five women over 60 years of age participated in the study. The mean age of the patients was 67.08± 4.7. A division into two study groups was made: group 1 – had 14 women and used only treatment with point laser therapy at 2500 Hz for 2 minutes [17], group 2 – had 11 women and used only treatment with low-frequency 50 Hz magnetotherapy with an intensity of 5 mT for 15 minutes [17]. In both groups, treatments were carried out at the same time of day, for a period of 2 weeks, 5 days a week. The participants did not use analgesic pharmacotherapy. Pain was assessed in both groups using the Numercial Rating Scale (NRS). The scale contains 11 levels of severity, divided into numerical values from 0 to 10, where 0 means no pain and 10 means very severe pain. The patient self-assessed the level of pain sensation. An assessment of quality of life was also performed using the standardised Roland-Moriss disability questionnaire, which consists of 24 questions that address simple activities of daily living [18].

The results obtained were subjected to statistical analysis using the Statistica 13.3 PL computer programme [19]. The occurrence of skewness and kurtosis further supported by the results of the Shapiro-Wilk test indicated that most of the parameters studied did not show a normal distribution in the groups studied. Therefore, a non-parametric statistics method was used. The research was conducted with the approval of the Ethics in Research Thematic Team of the National Chamber of Physiotherapists No. 10/2022. Study participants signed a written informed consent to participate in the study. Inclusion criterion women with a diagnosis of lumbosacral osteoarthritis, age 60 years or older, not taking pain medication. Exclusion criterion: no diagnosis, age less than 60 years, taking pain medication, no written consent to participate in the study.

RESULTS

Descriptive statistics in the study groups before and after magnetotherapy and laser therapy treatments were as follows (Table 1): for the NRS-Magnetotherapy_1 variable, the median was 8.00, the minimum was 5.00 and the maximum was 9.00. For the NRS-Magnetotherapy_2 variable, the median was 4.00, the minimum was 2.00 and the maximum was 8.00. For the DQRM-Magnetotherapy_1 variable, the median was 14.00, the minimum was 9.00 and the maximum was 23.00. For the DQRM-Magnetotherapy_2 variable, the median value was 8.00, the minimum was 3.00 and the maximum was 19.00. For the NRS-Laser Therapy_1 variable, the median value was 6.00, the minimum was 3.00 and the maximum was 10.00. For the NRS-Laser therapy_2 variable, the median was 3.00, the minimum was 0.00 and the maximum was 5.00. For the DQRM-Laser therapy_1 variable, the median was 14.50, the minimum was 4.00 and the maximum was 21.00. For the DQRM-Laser therapy_2 variable, the median was 4.50, the minimum was 2.00 and the maximum was 12.00.

The next step in the statistical analysis was to see which laser therapy or magnetotherapy treatments had an effect on reducing lumbosacral back pain. For this purpose, the Wilxocon's paired order test was performed. The level of significance was taken as $p<0.05$. A statistically significant

Table 1. Descriptive statistics for the Numeric Rating Scale (NRS) and the Roland – Moriss Disability Questionnaire (DQRM) before and after treatments in the magnetotherapy and laser therapy groups (_1 – before treatments, _2 – after treatments)

Variable	Descriptive statistics		
	Median	Minimum	Maximum
NRS-Magnetotherapy_1	8.00	5.00	9.00
NRS-Magnetotherapy_2	4.00	2.00	8.00
DQRM-Magnetotherapy_1	14.00	9.00	23.00
DQRM-Magnetotherapy_2	8.00	3.00	19.00
NRS-Laser therapy_1	6.00	3.00	10.00
NRS-Laser therapy_2	3.00	0.00	5.00
DQRM-Laser therapy_1	14.50	4.00	21.00
DQRM-Laser therapy_2	4.50	2.00	12.00

Table 2. Wilcoxon's scale NRS in the group of women with magnetotherapy

Variable pair	Wilcoxon's scale pair order
	p-value
NRS-Magnetotherapy_1 & NRS-Magnetotherapy_2	0.0033

Table 3. Wilcoxon's scale NRS in the group of women with laser therapy

Variable pair	Wilcoxon's scale pair order
	p-value
NRS-Laser therapy_1 & NRS-Laser therapy_2	0.0009

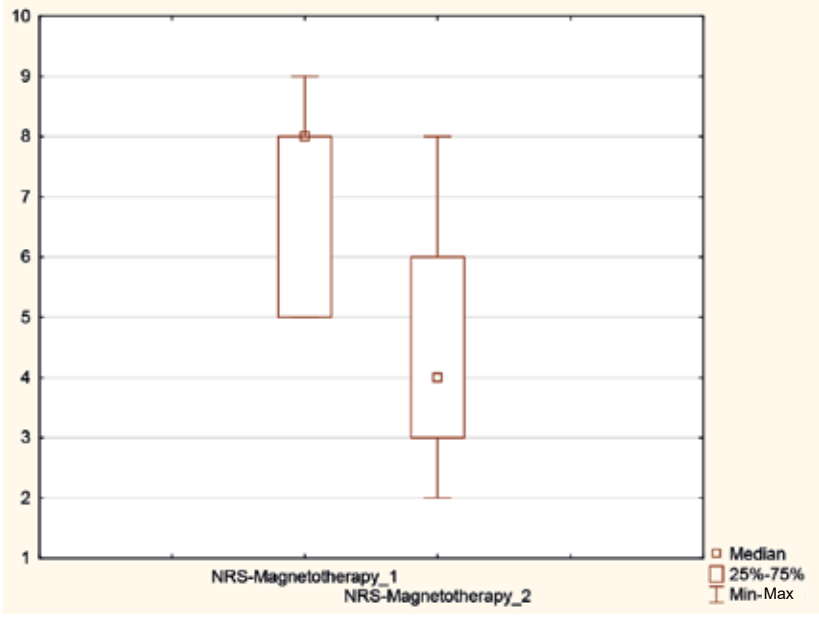

Fig. 1. Box-plot for pain sensations among subjects before and after magnetotherapy treatment.

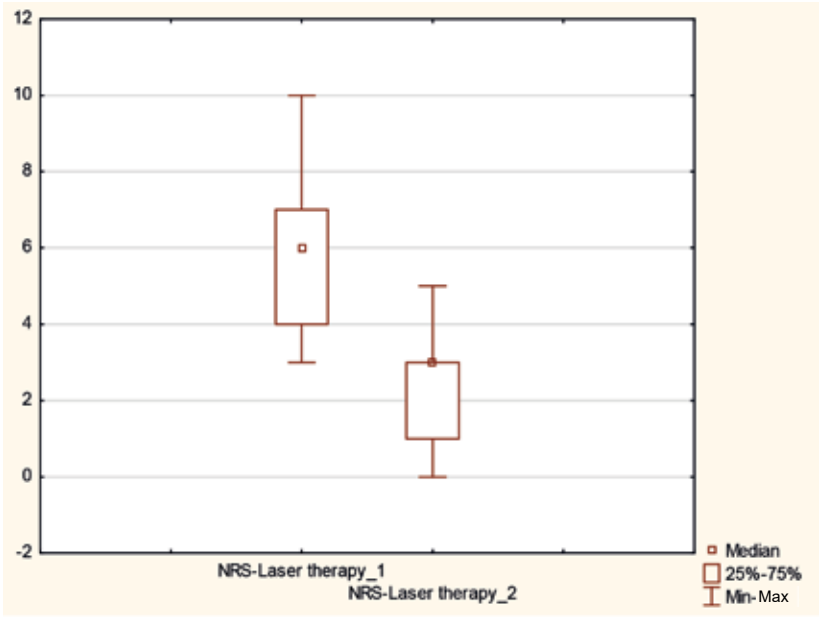

Fig. 2. Box-plot for pain sensations among subjects before and after laser therapy treatment.

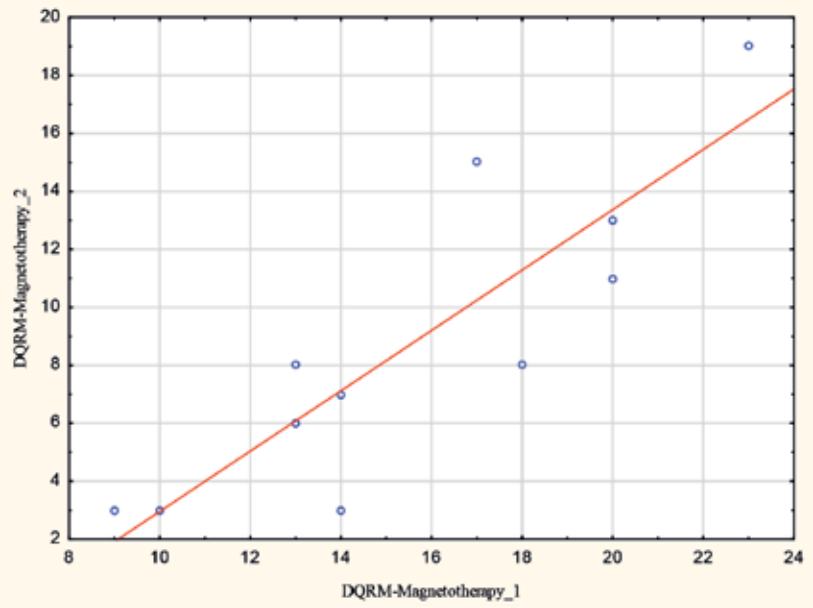

Fig. 3. Scatter plot of the Roland-Moriss questionnaire in the variable groups with magnetotherapy treatment.

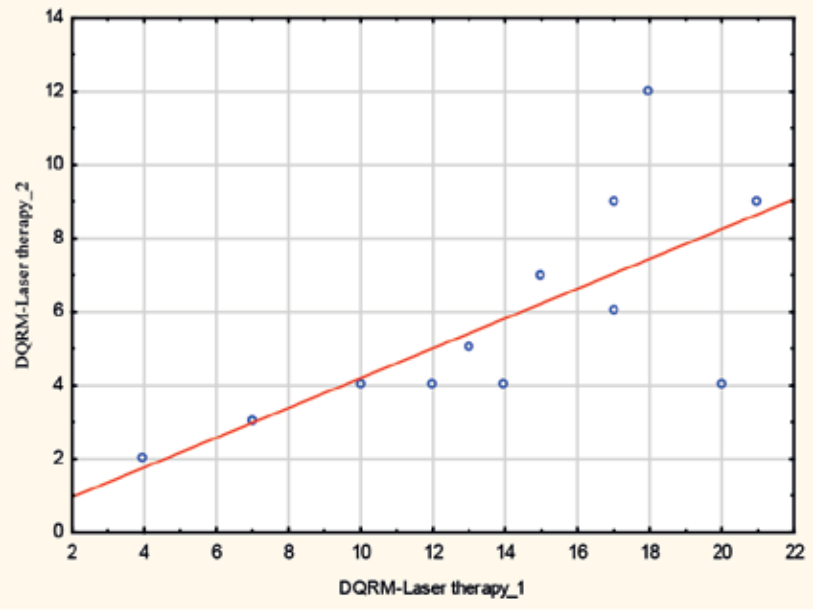

Fig. 4. Scatter plot of the Roland-Moriss questionnaire in the variable groups with laser therapy.

difference was noted for the reduction in pain sensations after the magnetotherapy treatments among the women studied p=0.0033 (Table 2, Fig. 1).

Also in the group with laser therapy performed, there was a significant statistical difference for a reduction in pain sensation after the treatments among the women studied p=0.0009 (Table 3, Fig. 2).

We then proceeded to analyse the Roland-Moriss Disability Questionnaire in the group of women who received magnetotherapy and laser therapy treatments. The scatter plot of the two variables RM-Magnetotherapy_1 (assessed questionnaire before the start of the magnetotherapy treatments) and RM-Magnetotherapy_2 (assessed questionnaire after the completed magnetotherapy treatments) shows lower values after the completed series of magnetotherapy treatments (Fig. 3).

In the group of women in which the laser therapy treatment was performed, the scatter plot of the two variables DQRM-Laser therapy_1 (assessed questionnaire before the laser therapy treatments) and DQRM-Laser therapy_2 (assessed questionnaire after the completed magnetotherapy treatments) shows lower values after the completed series of laser therapy treatments (Fig. 4). The score represents the sum of the marked answers to the questions, the greater the sum of the scores the greater the degree of impaired performance [18]. There are four degrees of quality of life impairment: none/slight – 0-3 points, medium – 4-10 points, large – 11-17 points, very large – 18-24 points [20].

DISCUSSION

The applied magnetotherapy and laser therapy treatments have reduced pain sensations among the female subjects. The main aim of treatment is to reduce pain, slow down the degenerative process, increase spinal mobility and thus improve quality of life with an overall improvement in a Operative treatment is carried out in cases of large spinal herniations or significant degenerative changes of the spine leading to stenosis [21]. Conservative treatment should include comprehensive physiotherapeutic treatment. In addition to the rehabilitation process, it is important to remember to educate the patient.ctivity. Treatment of degenerative changes of the spine can be conservative or surgical [21]. As part of prevention, the patient should lead an active lifestyle and plan his or her leisure activities on a daily basis, it is recommended to refrain from lifting weights and use ergonomic movement both at work and in daily life [22-24]. The use of physical therapy in degenerative changes of the spine is intended to reduce pain, inflammatory reaction and muscle tension.

Magnetotherapy stimulates peripheral blood circulation at the same time, accelerating regenerative processes through better oxygen supply to tissues, and also reduces the swelling that occurs. It is recognised as an effective method in the treatment of musculoskeletal disorders [25,26]. In a study by Pasek and co-authors, participants with lumbar pain with sciatica symptoms were divided into three groups. Low-frequency magnet therapies with different physical parameters were applied. The first group used magnetotherapy, the next group used magnetostimulation and the last group used magnetoledotherapy. Before and after the treatments, the Visual Analogue Scale (VAS) was used and a significant reduction in pain was observed. This allowed patients to reduce the use of painkillers or stop taking them altogether. The study also showed an improvement in patients' quality of life. Regardless of the physical parameters used, low-frequency magnet therapy had a beneficial effect on reducing lumbosacral spine complaints [27]. A study by Radzimisek and co-authors included a group of people with chronic lumbosacral spine pain caused by degenerative changes in the spinal joints and overload-pain syndrome. The patients were divided into 3 groups and physical therapy treatments were applied to them. In the first group, peoidotherapy was performed, i.e. mud was used for the treatment, in the next group a sonotherapy treatment was applied and in yet another group a magnetotherapy treatment was used. The treatments were performed in all groups, daily for a period of 2 weeks. The Oswestry Disability Index (ODI) questionnaire was used and confirmed a significant reduction in the level of disability caused by back pain in each of the three groups. The groups were compared with each other and the most effective results were shown in the sonotherapy group, while the least beneficial results were shown when patients underwent magnetotherapy [28].

A laser is the amplified light through the forced emission of radiation. The main characteristics of laser radiation are monochromaticity, coherence, parallelism, and intensity. During laser biostimulation, the temperature of the tissues treated should not rise above 1 degree Celsius, so it can be used for both acute, subacute and chronic conditions. A distinction is made between high-energy and low-energy lasers. A number of studies to date show that low-energy lasers result in improved microcirculation, increased myelination and growth of nerve fibres and increased enzyme activity [29]. Laser therapy treatment is used to treat degenerative changes in the spine and has no age contraindications [30]. A study conducted by Fiore and co-authors in a group of patients with lumbosacral pain was divided into two groups. One group was assigned high-intensity laser therapy treatments, while the other group was assigned ultrasound therapy. The results showed that after a series of 15 treatments, there was a significant reduction in pain levels in the laser therapy group, as measured by the VAS scale. The OLBRDQ questionnaire was also used, which indicated a significant difference in the reduction of disability in those with laser therapy. The efficacy of laser therapy was also proven in a study by Jovicić and co-authors. Patients with acute lumbosacral pain were divided into three groups with laser therapy treatments. Treatments with different physical parameters were applied in each group. A significant difference was observed in the level of reduction in pain before and after the treatments, as measured by the VAS scale. As a result, all energy doses in the 3 groups were shown to be equally effective in reducing or getting rid of lower back pain. Research and co-authors Abdelbasset also proved the effectiveness of laser therapy treatments. Kocjan's study divided patients with lower back pain into four groups. Two of them were placebo groups, and two received low-energy laser therapy and ultrasound treatments. Patients who received physical therapy differed in the position in which it was performed. At the end of the study, results indicated negligible improvement in pain as measured by the VAS scale. The groups in which there was little improvement were those with physical therapy performed and those with placebo in the supine position. Pain complaints of patients who underwent seated procedures did not change to any extent. Tumors and co-authors studied patients diagnosed with chronic lumbar spine pain syndromes. They were divided into 2 groups, the first of which received physical treatments in the form of TENS currents, sollux lamp and magnetotherapy. The second group was assigned the same physical treatments with the addition of laser therapy. After the study was completed, it was shown that pain levels decreased in the group with laser therapy, but the therapy itself was no more effective than the therapeutic program prepared for the first group. Mika writes that an important role, in addition to prevention and appropriate treatment, is played by physical therapy, which itself is an important part of physical medicine [17]. Mach-Ossowska, on the other hand, confirms in her work that physical therapy activities improve patients' quality of life and reduce pain. A combination of physical therapy treatments and kinesitherapy was carried out in patients with lumbosacral spine lesions showed a significant difference in the in patients' pain sensations. A study by Kholoosa et

al. evaluated the effectiveness of laser therapy combined with nonsteroidal anti-inflammatory drugs in patients with lower back pain. In the study group, where the real laser was used, the abolition of pain was noted in 90% of the subjects, while in the control group, where the sham laser was used, it was 75%. The authors suggest that the combination of laser therapy and non-steroidal Abdildin et al. evaluated the effect of high-energy laser therapy on lower back pain. Their meta-analysis showed that patients undergoing the described therapy had significantly lower pain intensity. Based on the results, the authors indicate that high-energy laser is an effective form of therapy for patients with lower back pain, anti-inflammatory drugs is an effective form of therapy without significant side effects.

CONCLUSIONS

Magnetotherapy and laser therapy treatments have a beneficial effect in reducing lumbosacral pain sensations in women. A reduction in Roland-Moriss questionnaire values was also achieved in both study groups after the treatments.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Effectiveness of the use of peloidis in patients of reproductive age with chronic inflammatory diseases of the uterine appendages

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ABSTRACT

Aim: To study of the clinical effectiveness of the use of medicinal mud of the Shabolat estuary "Akvilon" in the complex treatment of chronic inflammatory processes of the uterine appendages in women of reproductive age.

Materials and Methods: The prospective study was conducted of 40 patients with chronic inflammatory diseases of the appendages (the main group) who were treated according to the proposed scheme with the addition of therapeutic mud "Akvilon" and 22 patients who made up the control group and were treated according to the generally accepted scheme. The level of gonadotropins and sex hormones, the biocenosis of the vagina and the intensity of the pain component were determined.

Results: In patients who received the offered treatment scheme with the use of "Akvilon" therapeutic mud, the improvement in the general state of health, acceleration of the elimination of clinical symptoms of inflammation was revealed. The use of therapeutic mud made it possible to normalize the menstrual cycle, the biocenosis of the vagina, and reduce the pain component as a manifestation of the chronic inflammatory process.

Conclusions: The use in women with chronic inflammatory diseases of the appendages in the complex treatment of natural mud "Akvilon" contributes to the rapid regression of clinical manifestations of the disease, in comparison with standard therapy. The use of the drug allows you to normalize the hormonal background, accelerate the recovery of the vaginal biocenosis, treat the sebaceous process, which in the future will contribute to the desired pregnancy. The obtained results testify to the effectiveness of the therapeutic mud "Akvilon" and justify the need to use this group of drugs for the treatment and rehabilitation of women with chronic inflammatory diseases of the appendages.

KEY WORDS: therapy, adhaesive disease, therapeutic mud "Akvilon"

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INTRODUCTION

Chronic inflammatory diseases of the female genital organs not only dangerously remain the leaders in the structure of gynecological diseases, but are the most frequent cause of disruption of women's reproductive health, thus creating not only medical, but also social and economic problems. Chronic pelvic pain syndrome, infertility, miscarriage, ectopic pregnancy make up an incomplete list of the consequences of their negative impact on women's reproductive function [1-4]. Chronic inflammatory diseases of the uterine appendages occupy a leading place in the structure of gynecological pathology of the reproductive age and make up 60-65%. According to statistics, 75% of patients with inflammatory processes of the genital organs are women under 25 years of age, 3/4 of whom have not given a birth to a child. The incidence rate of the above-mentioned pathology for the first decade of the XXI century is 1.4 times increased among patients aged 18-24, it is 1.8 times higher among patients aged 25-29, respectively. The expenses for diagnosing and treatment have increased, which account for about 50-60% of all funds for providing gynecological care to the population [2, 5]. In the USA, inflammatory diseases of the female genital organs annually cause 2.5 million visits to the doctor, 200, 000 hospitalizations, and 100, 000 surgical interventions [6].

It should be taken into cosideration that chronic inflammatory diseases of the uterine appendages have a subclinical course and are characterized by the presence of periodic exacerbations with a painful component and menstrual dysfunction [3]. According to the National Health Service of Great Britain (NHS), in approximately one in four cases, inflammatory processes are caused by sexually transmitted infections, including Neisseria gonorrhoeae or Chlamydia trachomatis, Mycoplasma hominis [7]. Morphological and functional changes in the organs of the reproductive system caused by a long-term persistent infection cause pathological afferentation to the parts of the central nervous system that regulate the hypothalamic-pituitary-ovarian system. As a result of these changes, there is a decrease in the endocrine function of the ovaries, which leads to a violation of ovulation [8].

The formation of chronic inflammation is always based on the irreversible nature of the pathological process, which is not only in deep morphological changes in tissues, but also in their functional disorders. According to [9, 10], the inflammatory process in the fallopian tubes begins

with endosalpingitis, subsequently numerous small-cell inflammatory infiltrates are formed. At the same time, ulcer foci appear on the surface of the epithelium, which merge with each other, forming a small looped net. Due to the gluing of thickened fimbriae, obliteration of the opening of the fallopian tube occurs with the accumulation of inflammatory exudate in its lumen (hydrosalpinx) with possible subsequent gradual resorption. In cases of long-term preservation of the exudative process in the appendages of the uterus, tube fibrosis occurs, which leads to the destruction of lymphatic vessels located directly under the epithelium, disruption of blood and lymph circulation. Accumulation of fluid in the tube occurs as a result of continuous epithelial secretion and transudation from the vascular system. At the same time, the chronic inflammatory process is accompanied by the active development of fibrous elements, which causes the narrowing or obliteration of the fallopian tube, the appearance of peritubar and ovarian adhesions and the formation of tubo-peritoneal infertility, the specific weight of which in the structure of female infertility is 35-40% [1-4] .

The main role in the diagnosis of the causative agent in various biological material in chronic inflammatory processes of the female genital organs is played by laboratory methods [3, 7, 9]:

- microscopic (smear analysis for microflora);
- cultural (quantitative detection of the pathogen by classical bacteriological method);
- molecular biological (polymerase chain reaction – PCR);
- immunological (enzyme immunoassay – ELISA)

The standards of treatment of chronic inflammatory diseases of the female genital organs, which include a wide arsenal of anti-inflammatory and antibacterial drugs [2, 11, 12], are certainly important in the practical work of a doctor, but today the use of systemic antibacterial therapy, especially in chronic processes, does not solve in to the full extent of the specified problem, which prompts the search for new approaches to the therapy of this pathology. The choice of correction methods and means of therapy depends on the features of pathogenesis, clinical form, severity and duration of the disease [8, 9]. The implementation of this issue is necessary at all stages of providing medical care, starting at the observation stage in the women's consultation, during inpatient treatment and at the final stage of rehabilitation, which is sanatorium-resort treatment, generally recognized even in Europe [13-15]. The use of physical factors in gynecological practice is an extremely important component of full-fledged and effective treatment of many diseases with which obstetricians-gynecologists face in their routine [13-15]. A pronounced therapeutic effect is observed when using mud, ozokerite or paraffin applications, tampons, as well as balneotherapy – baths, vaginal irrigation with mineral water. These procedures can be carried out both during sanatorium-resort treatment and out of hospitals and resort houses, which is relevant at the present time and is associated with many problems (material, household, etc.). Peloidotherapy (mud treatment) is one of the main methods of sanatorium-resort treatment used in gynecological practice. Its effect on the body is determined by the physical and chemical properties of therapeutic mud. It has desensitizing, resorptive and anti-inflammatory effects, reduces the activity of exudative and infiltrative processes (by reducing the influence of serotonin and kinins on some cellular reactions, as well as by reducing the activity of hyaluronidase), improves the functions of the ovaries (both directly and indirectly), the rheological properties of blood, the body's energy supply (due to the activation of redox reactions), increases immunological reactivity [13, 15, 16]. Taking into account the main pathogenetic links of chronic inflammatory processes of the genitals, we considered the possibility of using in complex therapy the therapeutic mud of the Shabolat estuary "Akvilon", which belongs to the type of sulphide-silt mud.

AIM

The aim of the research was to study of the clinical effectiveness of the use of medicinal mud of the Shabolat estuary "Akvilon" in the complex treatment of chronic inflammatory processes of the uterine appendages in women of reproductive age.

RESEARCH HYPOTHESIS

As a result of the chronic inflammatory process of the uterine appendages, the risk of formation of peritubal adhesions, narrowing and obliteration of the lumen of the fallopian tube increases, which subsequently has a high risk of formation of tubo-peritoneal infertility in women of reproductive age. The use of peloids in complex treatment and rehabilitation has a more pronounced therapeutic effect compared in comparison with standard methods of treatment due to the physical and chemical properties of mud and it will contribute to the treatment of the sebaceous process and prevention of its formation with timely use.

MATERIALS AND METHODS

The study is based on own clinical observations. Unfortunately, due to Covid-19 and the war, we have a limited number of patients. 42 female patients aged 19 to 36 took part in the project. Inclusion criteria were the presence of a verified diagnosis of "Chronic salpingitis", informed consent to participate in the study. Acute inflammatory processes of appendages, HIV-infected patients, systemic collagenoses, acute inflammatory processes of extragenital localization and lack of desire to participate in the study were exclusion criteria. Two groups were formed: the main one included 20 patients who, in addition to the standard treatment of the chronic inflammatory process of the uterine appendages (immunomodulatory, antibiotic therapy taking into account sensitivity, the use of biogenic stimulants), received intravaginal tampons containing sulfide-silt mud of the Shabolat estuary "Akvilon" for 14 days , lasting 30 minutes. The control group consisted of 22 patients with chronic salpingitis who received standard anti-inflammatory therapy, the duration of that treatment depended on the general condition and was 16 days in average. In dynamics, all women underwent general clinical and ultrasound

examination. In terms of age, parity, disease severity, the groups were representative and selected according to the copy-pair principle.

Ultrasound studies were carried out with the help of TOSHIBA NEMIOXG model SSA-580 A device using convex sensors with the power of 3.5 and 7.5 MHz, operating in real time.

The intensity of pain was assessed basing on the verbal descriptive pain assessment scale (Gaston-Johansson Verbal Descriptive Scale F., Albert M., Fagan E. et al., 1990), which makes it possible to assess the patient's subjective pain sensations during the examination: 0 – no pain; 2 – weak pain; 4 – moderate pain; 6 – severe pain; 8 – very strong pain; 10 – unbearable pain. Bacteriological research of vaginal secretion was carried out by using the "Femoflor-16" test. Determination of the hormonal status of the patients was performed according to the accepted method used in the medical laboratory "SYNEVO".

Statistical processing of materials was carried out by using variational statistical methods with the usage of the standard package of MS Office 365 Excel Windows'10'Home application programs. For quantitative characteristics, after calculating the descriptive statistical parameters within each sample, a check was made on the nature of the distribution. In case of normal distribution of similar characteristics in the samples, Student's test was used to compare them. In the absence of normal Gaussian distribution in bounded sets of quantitative traits (and also with rank characteristics), the comparison was made using non-parametric Fisher criteria. Mismatches between comparable values were considered statistically significant at the significance level of $p < 0.05$.

RESULTS

The average age of patients in group I was 25.71±3.19 years, while in group II it was significantly higher and equal to 27.15±4.22 years ($p<0.01$). Most of the examined women of both groups were residents of the city (90% in group I and 68.18% in group II) with secondary (60.0% and 75.0% respectively) or higher education (40.0% and 25 .0% respectively). When evaluating the main features of the obstetric and gynecological history of the examined women, high frequency of infertility (group 1 – 60.0% and group 2 – 59.1%) and spontaneous abortions (group 1 – 40.0% and group 2 – 31.8%) was revealed. As it has already been mentioned above, all the patients of the main groups had inflammatory processes, but in addition, there was a concomitant genital pathology. Its structure was dominated by pathological changes of the cervix (group 1 – 60.0% and group 2 – 36.4%), ectopic pregnancy (group 1 – 15.0% and group 2 – 9.1%). Among the clinical symptoms in patients of both groups, pain syndrome prevailed (group 1 – 85.0% and 72.2% of patients in the control group, respectively), dyspareunia (group 1 – 65.0% and 2 – 63.3%) and various disorders of menstrual cycle in the form of opsomenorrhoea, oligomenorrhoea and algodysmenorrhoea, the total number of which in percentage was 65.0% in the patients of the main group and 68.2% in the patients of the control group.

During the gynecological examination, it was proven that the intensity of pain before treatment in both groups was in the range of 7-9 points. The treatment led to a decrease in pain syndrome to 2-3 points in the patients of the control group, while the pain component was completely removed in the patients of the main group.

In all the groups before treatment, during ultrasound diagnostics, an increase in echogenicity was found out, infiltrates were detected, and the presence of a sebaceous process in the areas of the pelvis was visualized. Hydrosalpinx was diagnosed in 4 patients of the main group (20%) and in 3 patients of the control group (13.6%) during sonography. Standard treatment did not reveal significant positive changes in sonography. One patient of the control group (4.55%) underwent surgery due to deterioration of the condition, which was diagnosed as pyosalpinx. When conducting a control ultrasound examination, a decrease in echogenicity and infiltration in the adnexal areas was noted in the patients of the main group. In three patients (15%), regression of the hydrosalpinx due to a decrease in its size was noted, in one (5%) complete resorption of the above-mentioned formation. During ultrasonography, during standard treatment, the parameters of the ovaries were reduced in patients of the second group, namely: length by 23.5%, width by 25%, thickness by 29.4%, and volume by 31.2 %. Whereas in women who additionally received the peloid composition as treatment, a decrease in the length of the ovaries by 41.5%, 31%, 35.3%, 35% and 39.6% was noted, respectively.

The bacteriological examination did not reveal significant differences in the patients of both groups. S.epidermidis (75% of patients of the main group and 59.1% of patients of the control group) and representatives of the genus Corynebacterium (80% and 68.2%, respectively, according to the groups) were cultured most often. A reliable decrease of Lactobacillus spp. and Bifidobacterium spp. with a simultaneous increase in the number of E. coli, Enterococcus spp. and S. aureus, as well as the appearance of Bacteroides spp., Peptococcus spp. and Peptostreptococcus spp. was observed. It was expedient to carry out a bacteriological study in dynamics in order to determine the impact of the proposed treatment methods in comparison with the generally accepted ones (Table 1). An increase in the normal microflora of the vagina was proven in the patients of the main group, while there was no positive dynamics in the women of the control group, in which the presence of associations of microorganisms, especially their anaerobic representatives, is observed, which poses a threat to the reproductive health of a woman. Therefore, the issue of restoring the biocenosis of the vagina during treatment is relevant, and the need for its restoration is obvious.

No pathogens such as Chlamydia trachomatis, Mycoplasma hominis were detected in the patients of both groups during the examination using the polymerase chain reaction. While the use of enzyme-linked immunosorbent assay (ELISA) contributed to the detection of Ig class G to Chlamydia trachomatis in patients of the main group in 40% of cases (8 patients), to Mycoplasma hominis in

Table 1. Quantitative polymerase chain reaction «Femoflor-16» results

Examination results	Indications for treatment, CFU /ml p<0,05		Indications after treatment, CFU /ml p<0,05	
	main group	control group	main group	control group
Lactobacillus spp.	3,4±0,2	3,5±0,4	6,3±0,1	3,4±0,2
Bifidobacterium spp.	3,0±0,2	3,3±0,1	4,3±0,2	3,6±0,2
E.coli	3,8±0,2	3,4±0,2	-	1,4±0,4
Enterococcus spp.	6,3±0,3	5,4±0,2	1,7±0,3	3,7±0,3
S.aureus	5,8±0,3	5,2±0,3	-	-
Bacteroides spp.	3,2±0,2	3,0±0,1	-	-
Peptococcus spp.	3,9±0,2	2,8±0,3	-	-
Peptostreptococcus spp.	3,7±0,3	3,5±0,3	-	1,4±0,3

5 patients (25%), respectively, the combination of both pathogens according to the examination results occurred in 3 patients of the main group – 15% of cases. In patients of the control group, these indicators were 40.9%, 27.3% and 18.2%, respectively. Based on the obtained results, it should be taken into consideration that the use of ELISA is a more informative and appropriate method of diagnosis in women with chronic inflammatory processes. In our opinion, this is most likely related to the elimination of the causative agent from the site of the primary lesion against the background of the long-term course of the inflammatory process and the use of antibacterial therapy.

Hormonal screening before the start of treatment proved that patients of both groups who participated in the study showed a significant decrease in the content of estrogens (E) (11.7±2.4 nmol/l – the main group, 10.4±3.6 nmol /l-control group) in blood serum against the background of an increase in the level of follicle-stimulating hormone (FSH) (15.6±1.2 mIU/ml and 15.7±1.4 mIU/ml, respectively) and luteinizing hormone (LH) (12.5 ±4.1 mIU/ml and 12.7±4.5 mIU/ml) hormones. It was proved that the progesterone (Pg) index was also significantly low in patients of both groups (1.7±1.2 nmol/l and 1.8±1.6 nmol/l). After 3 months of treatment, in the patients of the main group, there was an increase in sex hormones (E – 24.4±2.4 nmol/l; Pg – 18.5±2.2 nmol/l) with the normalization of gonadotropin indicators (FSH – 8, 5±2.2 mIU/ml and LH -6.8±4.2 mIU/ml) (Table 2). The patients of the main group also noted the normalization of menstrual function in 90% of cases (18 women). At that time, analyzing indicators of hormonal status, the normalization of menstrual function was found out in 54.5% (12 patients) of control group patients. Hormone levels were 16.5±1.2 nmol/l, 15.5±4.2 nmol/l, 11.6±3.2 mIU/ml and 10.5±1.2 mIU/ml, respectively. Manifestations of ovarian insufficiency in the examined group of women, most likely, indicate violation of the rate of development of the dominant follicle with subsequent formation of luteal insufficiency, which in our view requires correction and restoration of the hypothalamic-pituitary-ovarian hierarchy by using oral contraceptives during treatment.

No allergic reactions or side effects were observed when using Akvilon in the complex treatment of patients with chronic inflammation of the uterine appendages.

Thus, the results obtained during the study indicate a positive effect of peloid applications on the health of patients with chronic inflammatory diseases of the uterine appendages and acceleration of the elimination of clinical signs of inflammation in them.

DISCUSSION

Chronic inflammatory diseases of the appendages of the uterus occupy a leading place among gynecological pathology and have a tendency to increase, especially among women of reproductive age, which cannot help worrying specialists [1-4]. With the chronic course of inflammatory processes of the uterine appendages, an irreversible process is formed,

Table 2. Results of hormonal screening

Examination results (units of measurement)	Indications for treatment, p<0,05		Indicators after treatment, p<0,05	
	main group	control group	main group	control group
Estradiol/nmol/l	11,7±2,4	10,4±3,6	24,4±2,4	16,5±1,2
FSH/mIU/ml	15,6±1,2	15,7±1,4	8,5±2,2	11.6±3,2
LH/ mIU/ml	12,5±4,1	12,7±4,5	6,8±4,2	10,5±1,2
Progesterone/ nmol/l	1,7±1,2	1,8±1,6	18,5±2,2	15,5±4,2

which leads to deep morphological changes, and as a result, to violation of their functions, which increases the risk of tubal-peritoneal infertility and the occurrence of ectopic pregnancy [9, 10]. Chronic inflammatory diseases of the uterine appendages have a subclinical course and are characterized by the presence of periodic exacerbations with a painful component and disorder of menstrual function [3] due to pathological afferentation to the regulation centers, which violates the hypothalamic-pituitary-ovarian hierarchy [8]. As a result of the long course of inflammation and inadequate treatment, microbial agents, and most of all their associations, lead to the formation of capsules and crypts that reduce the bioavailability of drugs, namely antibiotics. Microorganisms are also characterized by the transition to insensitive antibiotic-resistant forms. Therefore, for the purpose of verification, the complex of laboratory-diagnostic methods is used, which include microscopic, cultural, molecular-biological and immunological diagnostic methods [3, 7, 9].

Treatment of chronic inflammatory processes of the uterine appendages should be comprehensive, taking into consideration the causative agent, its sensitivity to antibiotics, and the nature of its life cycle. The use of drugs whose action is aimed at dissolving the sebaceous process in complex treatment in most percent of cases leads to the normalization of the patient's condition, the restoration of generative function due to desensitizing and anti-inflammatory effects, a decrease in the activity of exudative and infiltrative processes, a decrease in the activity of hyaluronidase, which leads to an improvement in the function of the ovaries , increasing the immunological reactivity of the patient's organism [13, 15, 16]. The use of such drugs, even in outpatient settings, makes it possible for patients with chronic inflammatory processes to receive effective therapy in today's conditions. The offered treatment scheme requires further study over time and correction in order to improve it.

CONCLUSIONS

Thus, it can be concluded that:

1. The chronic course of inflammation of the uterine appendages is accompanied by violation of the biocenosis of the vagina in most cases, hormonal imbalance, which is associated with disorder of the rate of development of the dominant follicle with the subsequent formation of luteal insufficiency, which in our view requires correction and restoration of the hypothalamic-pituitary-ovarian hierarchy through the use of oral contraceptives during treatment.
2. The results of the control examination proved that as a result of the offered treatment, the number of normal microflora of the vagina in the women of the main group increased, which, most likely, is related to the normalization of menstrual function, but the use of drugs to restore the biocenosis is more appropriate.
3. The use of therapeutic mud "Akvilon" improves the condition of gynecological patients with inflammatory processes. The clinical effectiveness of the offered rehabilitation measures is confirmed by the results of additional research methods: microbiological, endocrine.
4. The offered scheme of treatment will provide an opportunity in the future for patients with chronic inflammatory diseases of the appendages to realize the reproductive function and coming of the desired pregnancy.

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CONFLICT OF INTEREST
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ORIGINAL ARTICLE

The influence of personality and temperamental traits on the perception of a sports injury

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ABSTRACT

Aim: A study was conducted on the relationship between personality and temperamental traits and the perception of trauma.

Materials and Methods: The study involved 50 people practicing extreme and high-risk sports and 50 people practicing non-extreme sports. The study used: the BFI-10 Personality Questionnaire translated by Jan Fazlagić, the Sensation Seeking Scale (SSS-V) by Zuckerman and the Scale of Perception of Injury in Sports by J. Blecharz.

Results: Statistically significant differences were detected in the intensity of personality and temperamental traits and injury perception between groups, as well as statistically significant correlations between the results obtained in the BFI-10 Questionnaire, SSS-V Scale and the Injury Perception Scale in Sports.

Conclusions: There is a relationship between the type of sport practiced and personality and temperamental traits. Personality and temperamental traits have a weak or moderate impact on the perception of trauma.

KEY WORDS: perception, personality, character traits, sport, injury

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INTRODUCTION

According to the Declaration of Standards in Physiotherapy adopted by the European Region of the World Confederation of Physiotherapy, "physiotherapy consists in providing individuals and populations with services resulting in the development, maintenance or restoration of motor activities and functionality throughout the patient's life" [1]. This definition is based on biomedical theory, in which a person is treated as a complex, physico-chemical system, and a disease is a disorder of this system."[2-4]. It could therefore be concluded that the effectiveness of therapy depends only on the skills of the physiotherapist and the type and prognosis of the disease. On the other hand, a patient is not just a "disease", but a person with a personality and temperament that influence various areas of his life. This perception of the patient is presented in a holistic model. In a holistic approach, a human being is a creature that, in addition to its physical dimension, also has a mental and spiritual dimension [5]. Currently, one of the most popular personality models is the Five-Factor Personality Model by Paul Costa and Robert McCrea, called the Big Five, used in the BFI-10 Personality Questionnaire. This concept views personality in terms of five traits (dimensions): neuroticism, openness to experience, agreeableness, extraversion and conscientiousness.The first of these features reflects emotional adaptation vs. emotional imbalance (susceptibility

to experiencing negative emotions: fear, confusion, anger, guilt and sensitivity to psychological stress). Another dimension of the Big Five is extraversion, which describes the quantity and quality of social interactions and the ability to experience positive emotions. The third component of the Big Five is openness to experience, which describes a person's tendency to seek out and give positive meaning to life experiences. Agreeableness is characterized by positive vs. negative attitudes towards other people. This feature is described on three levels: cognitive (trust or lack of trust in other people), emotional (sensitivity or indifference to other people's affairs) and behavioral (cooperative or competitive attitude towards others). The last element of the Big Five is conscientiousness, which describes the level of organization, perseverance and motivation of a person in pursuing a goal, and therefore his attitude to work. All the above-mentioned factors characterize a normal personality, although the extreme intensity of the features may, but does not have to, contribute to the development of behavioral disorders and psychosomatic diseases [6-9]. The theory of the mechanisms responsible for undertaking risky behavior is the theory of sensation seeking. Marvin Zuckerman believed that for cognitive and motor activity there is a certain optimal level of stimulation and activation that is different for each person. Achieving optimal stimulation of the body is a condition for experiencing a positive emotional state. Zuckerman introduced the term sensation seeking, which describes a temperamental trait expressing a tendency to seek or avoid stimulation. As Zuckerman wrote, it is a feature defined by the search for various new, complex, intense sensations and experiences. It also involves being willing to take risks (physical, social, legal and financial) in order to have these types of experiences. Importantly, Zuckerman emphasizes that it is not so much the physical value of stimulation that is important, but its meaning is different for everyone depending on their experiences. Sensation seeking consists of four factors: thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility [10-14]. Interdisciplinary activities are used in spa medicine. Due to the holistically focused work system in the field of balneoclimatology and physical medicine, taking into account personality and temperamental characteristics may be valuable in the treatment process, as well as patients' sports interests. The aim of the study is to find the relationship between personality and temperamental traits in amateur athletes practicing extreme and non-extreme sports.

AIM

A study was conducted on the relationship between personality and temperamental traits and the perception of trauma.

MATERIALS AND METHODS

The study involved 100 people aged 18 to 35 practicing sports at an amateur level. The inclusion criteria for the study were: age 18-35, practicing sports at an amateur level for at least 3 years and suffering an injury while practicing sports activities. The respondents were assigned to one of two groups. The first group consisted of 50 people aged 20-35 (22 women and 28 men) practicing non-extreme sports such as volleyball, fitness, road cycling, swimming, strength training, football and tennis. The median age in the group was 27.36 years with a standard deviation of 3.75. The second group consisted of 50 people aged 18-33 (20 women and 30 men) practicing extreme and high-risk sports such as climbing, mountaineering, mountain biking, freeride cycling and extreme snowboarding, where the median age was 26.9 years with a standard deviation of 3.2. In both groups, the experience in practicing sports was similar, in the first group the median experience was 11.7 years (sd 5.16) and in the second group 10.6 years (sd 4.3).

The study used:

- BFI-10 personality measurement questionnaire – The scale measures the intensity of five personality traits: neuroticism, extraversion, openness to experience, conscientiousness and agreeableness. The intensity of a given feature may range from -4 (very low intensity of the feature) to 4 (very high intensity of the feature), and 0 means approximately average [3].
- Sensation seeking scale, form V (SSS-V) – measures the temperamental trait of sensation seeking. Each subscale can be scored from 0 to 10 points (0 means low intensity of the trait, 10 means very high). The maximum number of points that can be scored in SSS-V is 40 [10,11].
- Injury Perception Scale in Sports, in which respondents are obliged to respond to thirty sport definitions according to their own opinion on a scale from strongly disagree to strongly agree. On the basis of the completed questionnaire, the respondent's attitude towards a sports injury was assessed in the following aspects: reflection and searching for positive sides, negative emotions related to the injury and downplaying injuries.

RESULTS

StatSoft Statistica 10 (StatSoft Inc) was used to prepare the results. The analysis used the non-parametric Student's t-test for independent samples because there was no normal distribution in the collected data during the analysis.

Analyzing the BFI-10 Personality Questionnaire, the groups in all components of the Questionnaire showed a statistically significant difference in the number of points scored. People assigned to the group practicing extreme sports, on average, statistically obtained more points determining the intensity of five personality traits. The biggest difference concerned the neuroticism feature, where people assigned to the second group scored on average 1.87 points more than people who did not practice extreme sports. Table 1 below contains a detailed distribution of points obtained in the BFI-10 Questionnaire.

In the analysis of the SSS-V Scale results, statistically significant differences were noted between the groups, both taking into account the sum of all points obtained and in individual subscales. The greatest statistically significant difference was noted in the susceptibility to boredom

Table 1. Distribution of points obtained in the studied groups in the BFI-10 Questionnaire

	Group 1		Group 2		p*
	mean	sd	mean	sd	
Neuroticism	0.38	0.16	2.25	0.26	0.00
Extraversion	1.82	0.55	2.10	0.47	0.00
Openness to experience	1.41	0.65	2.75	0.78	0.00
Conscientiousness	1.40	0.48	2.19	0.32	0.00
Agreeableness	1.63	0.11	2.36	0.28	0.00

*sd – standard , deviation, *between groups.*

Table 2. Subjects' results on the SSS-V scale and subscales

	Group 1		Group 2		p*
	mean	sd	mean	sd	
Total points on the SSS-V scale	22.30	1.76	31.4	2.12	0.00
Thrill and adventure seeking	7.00	0.26	8.60	1.17	0.00
Experience seeking	5.40	0.92	7.60	0.64	0.00
Disinhibition	5.82	1.61	7.00	1.52	0.00
Boredom susceptibility	3.51	2.01	6.35	2.15	0.00

*sd – standard deviation, *between groups.*

Table 3. Distribution of the results obtained in the second part of the Sports Injuries Perception Scale in the studied groups

	Group 1		Group 2		p*
	mean	sd	mean	sd	
Reflection and looking for positive sides	37.02	1,64	40.34	1.25	0.04
Negative emotions	29.50	0.86	29.63	0.73	0.89
Downplaying	33.84	1.23	30.98	1.01	0.00

*sd – standard deviation, *between groups.*

subscales, where on average people practicing extreme sports scored 2.84 points more than people practicing sports considered non-extreme, and in the experience-seeking subscale, where people assigned to the second group scored on average 2.20 points more than the first group. Detailed results obtained in the SSS-V Scale and its subscales are presented in Table 2.

The Sports Injury Perception Scale was also used during the study. It assessed the attitude towards injuries in terms of reflection and searching for the positive sides resulting from the injury and its consequences, negative emotions associated with it, as well as downplaying the injury. In terms of the first aspect, the group of people practicing extreme sports scored on average more points supporting consideration and a positive attitude towards the issue of sports injuries. This was also a group that downplayed the problem of injury and its possible consequences to a lesser extent. In terms of negative emotions related to the injury, both groups did not differ significantly in the number of points awarded. The distribution of points obtained in each aspect is presented in Table 3.

Additional analysis showed that people practicing extreme sports are characterized by a significantly higher intensity of sensation seeking and personality traits such as openness to experience, conscientiousness, neuroticism and extraversion than people practicing non-extreme sports. Moreover, in group II, a strong significant relationship was observed between the intensity of the traits: openness to experience and neuroticism (r=0.61) and agreeableness and neuroticism (r=0.58). The analysis also took into account the correlation between the results obtained in the BFI-10 Questionnaire and the Sports Injury Perception Scale. For this purpose, the Spearman Correlation test was used. In the case of the group not practicing extreme

Table 4. Correlation between personality traits and injury perception in athletes not practicing extreme sports

BFI-10 questionnaire / IPSS	Neuroticism	Extroversion	Openness to experience	Agreeableness	Conscientiousness
Reflection and searching for positive sides	0.025	-0.014	0.158	0.27*	0.37*
Negative emotions	-0.161	-0.139	0.28*	-0.20*	-0.203
Downplaying	0.26*	0.290*	0.250*	0.014	0.261*

**Injury Perception in Sports Scale, *statistical significance p<0.05.*

Table 5. Correlation between personality traits and the perception of injury in athletes practicing extreme sports

BFI-10 questionnaire / IPSS	Neuroticism	Extroversion	Openness to experience	Agreeableness	Conscientiousness
Reflection and searching for positive sides	0.20*	-0.39*	0.16	0.27*	0.28*
Negative emotions	-0.18	0.38*	0.03	0.16	0.13
Downplaying	0.27*	-0.03	0.22*	0.22*	-0.26*

*Injury Perception in Sports Scale, *statistical significance p<0.05.*

sports, weak but significant correlations occur between reflective attitude and agreeableness, negative emotions and openness to experience, and between downplaying and neuroticism. A negative, weak relationship was observed between Negative emotions and Agreeableness. A moderate relationship was detected between the reflective attitude and conscientiousness. In the case of the group declaring practicing extreme sports, weak but significant correlations were obtained between reflective attitude and neuroticism, agreeableness and conscientiousness, and between downplaying and neuroticism, openness to experiences, conscientiousness and agreeableness. A moderate relationship was detected between reflective attitude and extraversion and between negative emotions and extraversion. Tables 4 and 5 present the results of the correlation analysis between the above questionnaires.

DISCUSSION

Many references in the literature indicate that temperament may influence the type of experiences sought in life, and thus the choice of sports discipline. Similarly, personality may determine the type of sport practiced. Moreover, the direction of influence may be opposite, i.e. the selected type of activity may shape some personality traits [15]. Taking into account the recent popularity of extreme sports, a question arises about the differences in personality traits and temperament among people practicing extreme and non-extreme sports. The analysis of the research results conducted for the purposes of the presented work showed that people practicing extreme sports are characterized by a significantly higher intensity of sensation seeking than people practicing non-extreme sports. This means that people with a greater intensity of this temperament trait tend to engage in activities with a higher level of risk. This is confirmed by many other studies [16, 17]. Researchers from the University of Barcelona conducted research on four groups of athletes. Three of them included extreme athletes, the fourth, which was also a control group – non-extreme. All people, similarly to the needs of this study, were examined using the sensation seeking scale. Research has shown that people who score high on this scale have a greater tendency to engage in risky sports. The analysis of the research results of this work also showed the existence of a correlation between personality traits such as stability and openness to experience and the choice of sport. Extremely trained people are characterized by greater openness to experiences, conscientiousness, emotional stability and extraversion than non-extreme people [18]. Similar research results were achieved by Tok. He showed that people practicing extreme sports have a greater intensity of personality traits such as extroversion, emotional stability and openness to experience. However, this trend indicates that extreme athletes are less conscientious than the research conducted for this work showed. The results obtained by Tok are explained by the tendency among the mentioned athletes to become bored more quickly. On the other hand, high conscientiousness can be explained by the consequences of mistakes made while practicing high-risk sports. Some researchers, encouraged by the above-mentioned scientific reports, tried to go a step further and analyzed the impact of personality traits on the perception of injury among athletes practicing various sports disciplines [19]. Blecharz carried out such an analysis on a group of professional football and basketball players. His research showed a weak but significant positive correlation between the reflective attitude and extraversion and openness to experience. This means that people characterized by an extroverted attitude and openness to experiences tend

to reflect on the trauma suffered and look for the positive sides resulting from the injury [20]. The authors' research results in the group of people practicing low-risk sports differ from those mentioned above. A relationship was observed between the reflective attitude and agreeableness and conscientiousness. This relationship may result from the fact that agreeableness influences the experience of positive emotions in social contacts and facilitates the search for support. [21]. Another detected relationship was the influence of openness to experience on the intensity of negative attitude. This relationship may be dictated by the tendency in this research group to decrease the level of agreeableness as the intensity of openness increases. In a group of people practicing high-risk sports, similarly to Blecharz's study, research has shown a relationship between a reflective attitude and extroversion [20]. Despite a thorough analysis of the literature, no reports were found regarding the influence of sensation seeking on the perception of trauma. Two relationships were observed from the research conducted as part of this work. People practicing non-extreme sports show a negative, moderate relationship between the temperamental trait of sensation seeking and a negative attitude, while people practicing extreme sports show a weak but positive relationship between these factors. This means that people practicing high-risk sports are more likely to experience negative emotions in connection with an injury than people undertaking less risky forms of activity. The feeling of negative emotions among risk-taking athletes may be due to their greater conscientiousness. Conscientious people strive to achieve their goals, and getting injured means they are excluded from training. This is often associated with a significant delay in achieving physical fitness enough to return to sports. Moreover, it should be remembered that achieving optimal arousal is a condition for experiencing a positive emotional state [22, 23]. For people practicing extreme sports, trauma limits the ability to seek diverse, intense sensations and experiences, which may prevent them from achieving an optimal, satisfactory level of arousal. Both situations, the delay or inability to achieve fitness and the lack of appropriate stimulation, may cause them to experience negative emotions. Taking into account personality and temperamental traits as well as patients' sports interests may be valuable in the treatment process such as balneoclimatology and physical medicine. The use of mud compresses increases physical activity [24], which may in turn reduce negative emotions through the release of endomorphins from heat.

CONCLUSIONS

There is a relationship between the type of sport practiced and personality and temperamental traits.

Personality and temperamental traits have a weak or moderate impact on the perception of trauma.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Functional assessment of patients with systemic scleroderma. Recommendations for physiotherapists

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ABSTRACT

Aim: To analyze the functional performance of patients with generalized scleroderma treated at the Department of Dermatology of the PIM of the Ministry of Internal Affairs and to develop recommendations for physiotherapists. Systemic sclerosis (SSc) is a chronic connective tissue disease characterized by progressive fibrosis of the skin and internal organs, the presence of microcirculatory disorders and the presence of autoantibodies.

Materials and Methods: The study group consisted of 55 patients aged 27 years to 80 (mean 56.4) with systemic scleroderma, who receive rheological treatment in the Department of Dermatology on a cyclical basis. In addition, pharmacotherapy was supported by individually tailored rehabilitation for 2 years. Before and after the completed therapy, the results of the study were analyzed and recommendations were created for physiotherapists. Forty-two participated in the study.

Results: All patients had mobility restrictions in the proximal and distal interphalangeal joints of both hands and in both temporomandibular joints.

Conclusions: The study confirmed the need for guidelines for physiotherapists.

KEY WORDS: systemic scleroderma, rehabilitation, recommendations, SFTR angular measurements, hand joint ranges of motion – finger goniometer, temporomandibular joint ranges of motion

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INTRODUCTION

Functional fitness can be understood as the ability to perform basic daily life tasks safely and independently without excessive effort. Its assessment depends on the tests available and used by physiotherapists. Using neurological tests, a patient with systemic scleroderma often scores the maximum number of points, using orthopedic tests has some limitations, while rheumatic tests illustrate limitations of mobility in the joints of the hand, and this is still not a complete functional picture of the patient. Added to this are the occurrence of ulcers on the hands that prevent grasping or on the feet that cause an antalgic gait. In patients with generalized scleroderma there is limited mobility of the temporomandibular joints, narrowing of the oral crevice (microstoma) and labial redness and shortening of the frenulum of the tongue. The consequences are impaired food intake, maintenance of proper oral hygiene and difficulty in dental treatment [1]. Significant reduction in joint mobility can consequently lead to a number of complications. Deficiencies in functional ability, which become increasingly burdensome over time, often lead to complete dependence on another person. These limitations most often involve complex activities, such as those related to household chores, intellectual and occupational activities, operation of modern technologies. Over time, they gradually enter the area of basic activities related to independence in the immediate environment – bed, bathroom, home. The level of functional fitness also affects the patient's well-being. Hence, it is reasonable to view the systemic scleroderma patient in a multifaceted, holistic manner and not just as a sum of the scores of the research tool used. The large number of tools, their design, analyzed parameters and purpose make it difficult to uniformly perceive the results obtained and simplify the assessment of functional performance. Many times, the key role is played by the assessment of physical fitness parameters, such as muscle strength, which usually determine the ability to undertake certain behaviors related to self-care activities. Using one selected test does not give a complete picture of the patient. Most often, physiotherapists deal with the face and hands of a patient with systemic scleroderma and this is a disease that involves the entire body. Patient education, lifestyle recommendations and the use of selected physical treatments are also important aspects of management. For more than 20 years, the Department of Dermatology at PIM MSWiA has been treating patients with systemic scleroderma, a disease with a chronic and progressive course. The complex and varied clinical picture of patients requires multispecialist cooperation, hence the idea to include a physiotherapist in the team.

AIM

To analyze the functional performance of patients with generalized scleroderma treated at the Department of

Dermatology of the PIM of the Ministry of Internal Affairs and to develop recommendations for physiotherapists. Systemic sclerosis (SSc) is a chronic connective tissue disease characterized by progressive fibrosis of the skin and internal organs, the presence of microcirculatory disorders and the presence of autoantibodies.

MATERIALS AND METHODS

Fifty-five patients with systemic scleroderma, aged 27 years to 80 (mean 56.4), who receive cyclic rheological treatment in the Department of Dermatology at the National Medical Institute PIM MSWiA, were studied. For 2 years, pharmacotherapy was additionally supported by individually tailored rehabilitation. Before and after the therapy, the results of the study were analyzed. The Ethics and Supervision Committee for Research on Humans and Animals of the National Medical Institute of the Ministry of Internal Medicine approved rehabilitation during the patient's stay in the Department. After the medical examination, the physiotherapist developed an individual rehabilitation program on the basis of the measurements taken: a capacity test (six-minute walk test), the Marty Index (measurement of inhalation and exhalation at the height of the last rib and the gladius process of the sternum), assessment of motoricity (Barthel Index), angular measurements (according to the SFTR system), ranges of motion in the joints of the hand (finger goniometer), measurement of hand strength (dynamometer), assessment of hand function and limb circumference. Based on the results of the measurements, a kinesitherapy program was arranged. Each patient was trained in facial and limb self-massage and received an individual set of exercises for home (facial muscle facial exercises performed in front of a mirror, manual exercises for both hands, including with utensils such as matches and a cup). Measurements preceded and ended the project, as well as were conducted during the patient's 2-year follow-up. The study was supplemented by a detailed history of medical treatment, family history of autoimmune diseases, work in a harmful environment and use of physical treatments, among other things.

RESULTS

Analysis of the measurement results confirmed that patients with systemic scleroderma have a significant problem with function related to the mobility of the small joints of the hand and temporomandibular joints. The study group initially consisted of 55 people, including 42 women and 13 men, ranging in age from 27 years to 80 (mean 56.4), with an average treatment time of 8 years. Eventually, 42 people completed the project: 5 people changed the place of treatment, 1 was treated with alternative methods, three developed cancer (2-prostate, 1-breast), 1 person had a kidney transplant, 1 person had 2 heart ischemia, two people had to withdraw from rheological treatment due to the treatment of other conditions. The study continued with 35 women and 7 men, ranging in age from 28 to 80 years (mean age 57.57). Two patients had scleroderma diagnosed in the immediate family. Sixteen subjects worked in a harmful environment for 3 to 30 years (Fig. 1-12.)

All patients had mobility restrictions in the proximal and distal interphalangeal joints of both hands and in both temporomandibular joints.

DISCUSSION

Systemic sclerosis (SSc) is a disease that leads to multi-organ failure and disability that reduces quality of life. From our study, there is significant limitation of mobility in the small joints of the hands and temporomandibular joints.

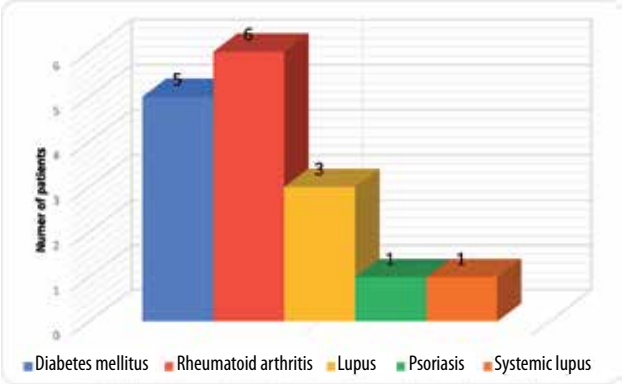

Fig. 1. Autoimmune diseases present in the family

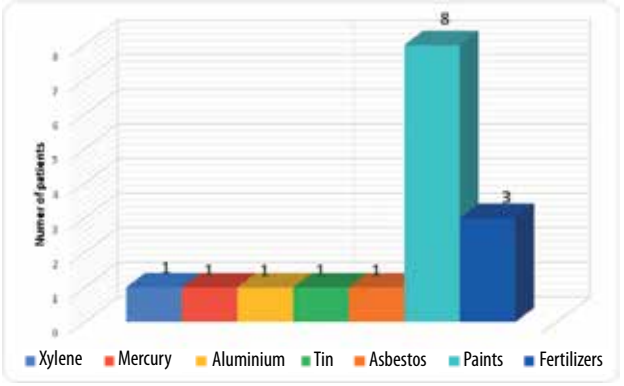

Fig. 2. Working in a harmful environment

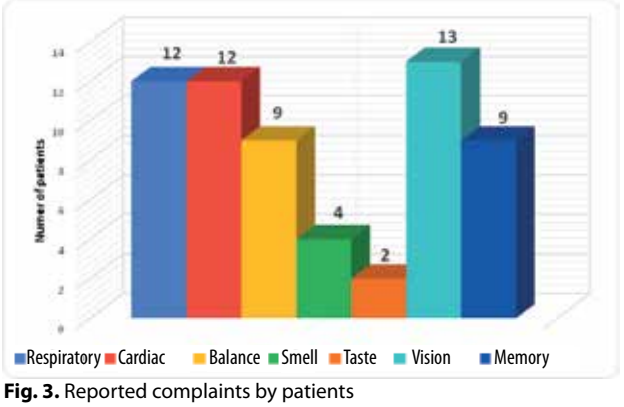

Fig. 3. Reported complaints by patients

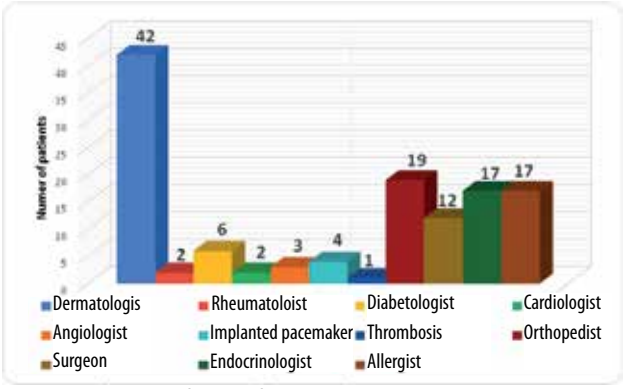

Fig. 4. Treatment with specialists

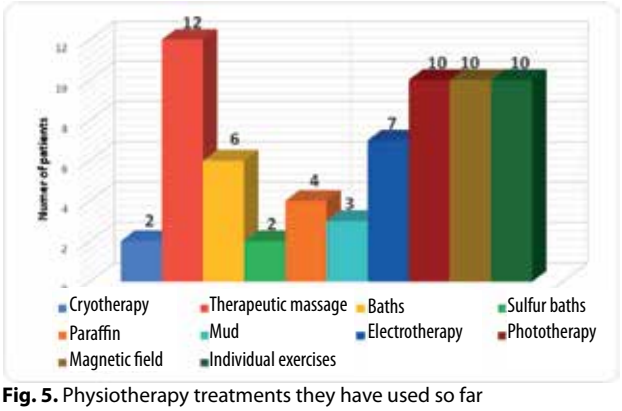

Fig. 5. Physiotherapy treatments they have used so far

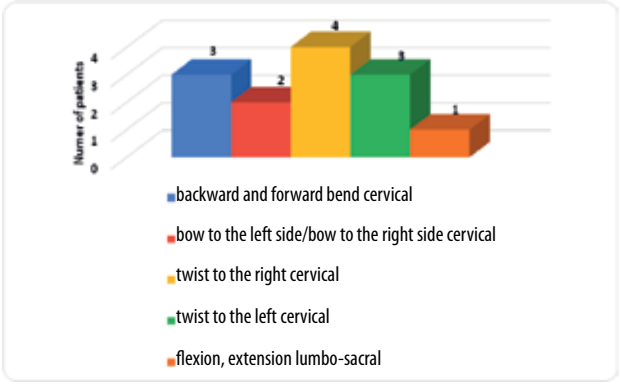

Fig. 6. Limitation of mobility in the cervical (c) and lumbar (l-s) joints

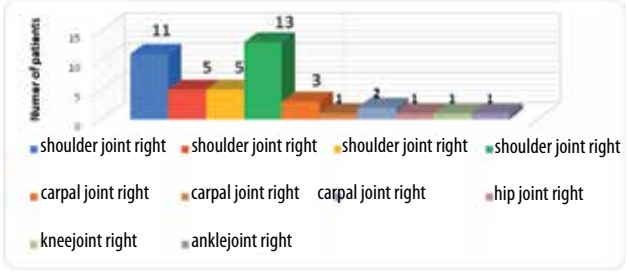

Fig. 7. Movement limitations in the upper and lower right limb

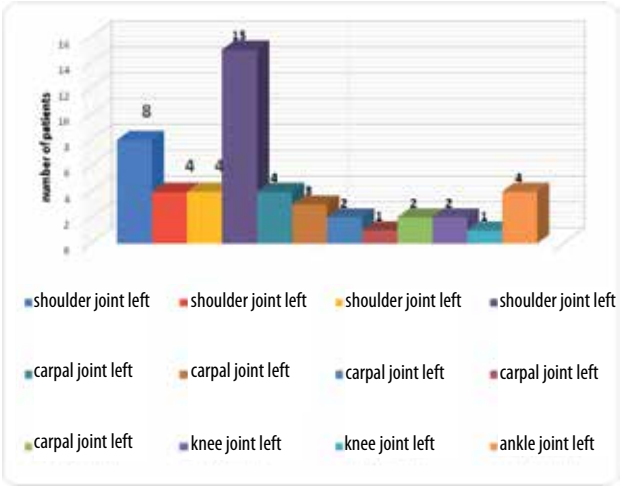

Fig. 8. Movement limitations in the upper and lower left limb

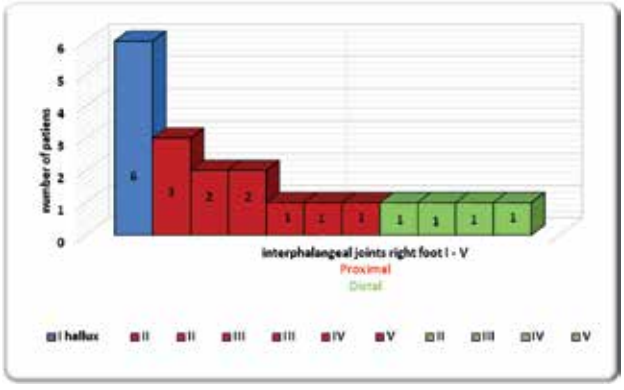

Fig. 9. Movement limitations in the toe joints of the right foot

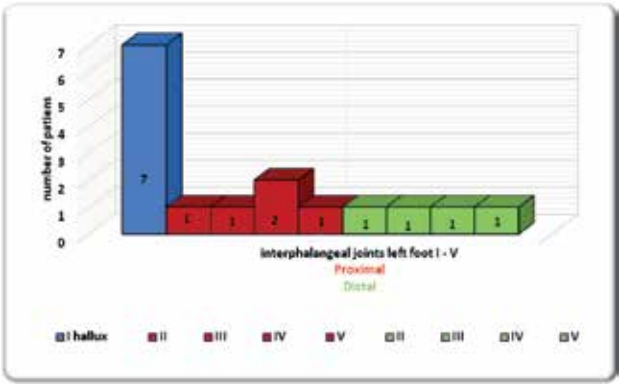

Fig. 10. Movement limitations in the toe joints of the left foot

The skin, subcutaneous tissue, muscles and internal organs are involved in the disease process [2, 3]. Microcirculatory disorders and excessive collagen synthesis leading to fibrosis of the skin and internal organs play an important role in the pathogenesis of the disease. The complex and varied clinical picture of SSc requires an individualized approach to the patient. The National Institute of Public Health conducted a study on the incidence of SSc in Poland between 2008

Fig. 11. The appearance of hands in a patient with systemic scleroderma

Fig. 12. Appearance of the skin around the oral crevice and labial redness of a patient with systemic scleroderma

and 2012, it was 9.4/100.000 people, giving an incidence of 1.9/100.000 people per year [4]. Systemic scleroderma is more common in women than in men. The disease is rarely seen in children and the elderly [4, 5]. In the course of SSc, the disease process involves internal organs such as the lungs, cardiovascular system, gastrointestinal tract and kidneys. For this reason, the disease has a highly variable clinical course, which depends, among other things, on the presence of organ complications [6]. Due to its complexity, recommendations of scientific societies of Polish dermatologists (European Dermatology Forum) [7, 8], rheumatologists (EULAR Scleroderma Trial and Research Group) [9], British [10], American, Canadian [11], Australian and New Zealand recommendations [12] have been created. The diagnostic and therapeutic management is decided by the attending physician, selects individually for each patient, after analyzing the history, clinical picture and results of additional tests. It seems reasonable to also create physiotherapeutic recommendations to support the treatment of patients with generalized scleroderma. Most commonly, rehabilitation is carried out to prevent movement limitations, prevent edema and improve general condition [13,14]. In addition to conducting improvement aimed at the hands and face, systemic improvement techniques are introduced, the disease also occupies other parts of the body causing pain and postural disorders [15,16]. Patients who do not have ulcers and open wounds can benefit from hydrotherapy. Special exercises performed in a pool with a water temperature of about +30°C, using the physical properties of water, have been shown to have a beneficial effect on the overall mobility of patients with SSc [15]. An important element in improving fitness is breathing exercises that engage the diaphragm, which increase exercise tolerance, thereby improving patients' quality of life [17]. Rehabilitation of microstomia is based on performing facial exercises that mimic facial grimaces and self-performing exercises that stretch and improve mouth opening [18, 19]. Basing facial rehabilitation solely on home exercises often does not bring the expected and satisfactory results, so more and more often several methods of physiotherapy are combined, e.g. self-massage of the face for 10-15 minutes each 3 times a day preceded by warming up the tissues with a thermophore [19-21]. It is recommended to start therapy with connective tissue massage but not only in the face, but also in the neck and periorbital area for about 10 minutes 2 times a week [15, 19]. A neurorehabilitation technique called the Kabat Method can be applied to the affected facial muscles, the goal of which is proprioceptive, neuromuscular paving of movement patterns. Muscles are stimulated through stretching and resistance work. The following muscles are treated: the circular mouth, zygomatic, lever lip, nasal, cheek, occipito-frontal and facial muscles. It is recommended to perform twice a week for about 15 minutes [15, 19]. The most effective therapies confirmed by research are combined therapies: connective tissue massage, Kabat method and kinesitherapy, supplemented with home exercises [19]. Hand rehabilitation depends on the stage of the disease because the changes in the hand can be of different severity. In the early stages, swelling of the fingers is often found which can limit not only mobility, but also the dexterity of the hand [13]. The method recommended in the early stage of the disease, when swelling is present, is manual lymphatic drainage [13]. In the later stage, when fibrosis is present, treatment is aimed at preventing contractures in the joints and increasing hand dexterity. Therefore, during this period of the disease, a combination of different physiotherapy methods supplemented by home

exercise programs performed by the patients themselves is recommended [17, 22]. Manual lymphatic drainage stimulates the lymphatic system and improves the removal of excess fluid accumulated in the interstitial tissue. In addition, MDL stimulates the parasympathetic nervous system, which leads to vasodilation [23, 24]. MDL uses Vodder's basic grasp. According to this technique, massage begins at the base of the neck above the clavicles, followed by massage of the vessels and lymph nodes of the head and neck. The next stage is the massage of the upper limb, which starts from the most proximal part, moving successively from the shoulder to the wrist, and then the dorsal and palmar surfaces of the hand [13]. It is recommended that massage be performed on both upper extremities, starting with the less swollen one, with an average duration of about 1 hour [13]. Among the techniques that improve hand dexterity is connective tissue massage which improves blood flow and allows to relax the affected tissues by stretching them. Connective tissue massage is recommended for the forearm and hand, with an average time of about 10 minutes for each limb [13, 22-24]. It is believed that connective tissue massage can cause temporary improvement, but does not lead to long-term resolution of symptoms [25]. Therefore, it is recommended to combine it with other physiotherapy treatments. Joint manipulation using the Mc Mennell technique is a method that improves the mobility of the joints of the hand, causes pain reduction and contributes to stretching of periarticular structures. The treatment begins at the wrist, then continues distally, covering the metacarpophalangeal and interphalangeal joints in turn. The recommended duration is about 15 minutes per limb. After completion, an additional 5-minute connective tissue massage can be performed [13, 22]. Hourly treatments conducted twice a week have been found to have a beneficial effect. In addition to treatments provided by a qualified physiotherapist, it is necessary for patients with SSc to perform exercises at home on their own. The patient should flex, straighten, invert and adduct fingers 2 to 4 touching the thumb every day for about 20 minutes. Perform flexion and straightening at the wrist, as well as inversion and reversal of the forearms [22]. Improvements in range of motion are given by patients' self-performed finger stretching exercises [26].

CONCLUSIONS

The study confirmed that patients with scleroderma have statistically significant problems with small hand and temporomandibular joints.

Based on the study, recommendations were created for physiotherapists

1. Patient education about the disease, its chronicity and consequences, including the possibility of using selected physical and balneological treatments (contraindicated: cryotherapy and ultrasound).
2. Assessment of the patient's physical fitness, proposing an active lifestyle adapted to the patient's capabilities.
3. Proposing breathing exercises, adapted to the patient's condition.
4. Manual exercises and learning of self-massage of upper limbs.
5. Facial muscle facial exercises and facial self-massage.

It is advisable to continue ongoing studies to develop rehabilitation protocols and evaluate the long-term effects of therapy.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Physical activity and life satisfaction of students of physiotherapy and physical education at the close of the COVID-19 pandemic

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ABSTRACT

Aim: To learn and compare their level of physical activity (PA) and motivation declared by physical education students and future physiotherapists, as well as to evaluate their life satisfaction in the final phase of the pandemic of the COVID-19 pandemic.

Materials and Methods: A survey study covered 211 respondents (106 students of physical education (PE) and 105 future physiotherapists). The anonymous survey consisted of standardized questions regarding the level and goals of physical activity (IPAQ-SF and IPAO) and life satisfaction (SWLS).

Results: A high level of PA was demonstrated by 51.5% of men and 48.6% of women – 83.1% and 75.9% students of physiotherapy and physical education, respectively. Family was a determinant that did not motivate the students to take up physical activity. There was a better atmosphere in the professional environment encouraging physical activity in the group of PE students (3.19±1.28) than among future physiotherapists (2.82±1.28) ($p<0.001$). Future physiotherapists declared lower level of life satisfaction. In this group, the SWLS score was 23.5±5.95 compared to 25.4±5.45 among PE students.

Conclusions: At the close of the COVID-19 pandemic, the specificity of PE and physiotherapy studies as well as gender are variables that had a significant impact on the resumption, type and motives for undertaking physical activity and improving life satisfaction. PE students' perception of the importance of physical activity is more pronounced than that of future physiotherapists, which is a strong enough factor to increase their life satisfaction.

KEY WORDS: students, physical education, physiotherapy, physical activity, life satisfaction

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INTRODUCTION

Since the outbreak of the COVID-19 pandemic, it has become clear that the coronavirus infection will leave indelible traces on the development of the entire civilization, and its effects will be felt for a long time [1]. The pandemic not only caused enormous loss of life around the world and posed an unprecedented challenge to health care and education systems, but also radically changed the way of life of millions of people [2]. This "Novel Coronavirus Disease" has had a significant impact on social, economic and health issues, changing lifestyle habits and redefining priorities (WHO) [3]. Globally, the urgent need to cope with daily concerns related to the pandemic has resulted in partial or complete interruptions of healthcare services [4]. Rehabilitation services, including health resort therapy, were disrupted, even though rehabilitation plays a decisive role in recovery from severe illness caused by the SARS-CoV-2 virus. The pandemic may provide an impetus to rethink the role of health resort therapy and rediscover its function as an "essential service" [5]. The beneficial effects of this therapy, especially through balneotherapeutic interventions, on diseases of the musculoskeletal system, lungs, circulatory system and skin, are well known [6]. Moreover, health resort therapy has a positive effect on mood, sleep quality and life satisfaction in general [7].

During the pandemic, virtually every person has faced restrictions in their lives. Educational institutions were forced to switch to remote teaching, which resulted in financial, technical, methodological and even psychological problems [8]. Higher medical education and fields such as physical education were particularly affected. While remote learning was possible in humanities and social sciences, in medical sciences, health sciences and physical culture sciences, it turned out to be extremely problematic due to their practical profile [9]. For higher education entities, including those educating physiotherapists and physical education teachers, the need for emergency implementation of e-learning tools to conduct remote teaching has become a challenge. In these fields, practical classes were difficult or even impossible to conduct, which caused additional concerns. Given the above, the pandemic has aroused great interest in analyzing the impact of this crisis on the

lifestyle of the entire population, and in particular on the student community [10].

The period of studies is the most favourable time for shaping the next stage of human development. However, students are one of the most vulnerable groups due to additional risk factors of a critical situation (poor nutrition, reduced life satisfaction, sedentary lifestyle, unknown course of the disease, social isolation) that may lead to deterioration of health during the pandemic [11]. A positive attitude towards taking up physical activity, which increases the fitness and functional capabilities of the body, becomes the foundation of a healthy lifestyle during the student period [12]. The COVID-19 pandemic has led to social isolation and, consequently, reduced physical activity [13]. Students, especially PE students and future physiotherapists, are the target group that most likely experienced major changes in everyday life during the crisis situation related to the pandemic [14]. Due to the specificity of their activities and PA level, students of these fields are considered role models for a healthy lifestyle. The COVID-19 pandemic has had a negative impact on general (mass) sport and competitive (professional) sport and its participants: athletes, coaches, trainers and instructors [15]. The level of physical fitness, and thus the condition of competitors, decreased. As a result, the financial profits of both players and coaches melted away. Also the possibilities of participating in sports competitions diminished, especially that it was time to prepare for the Olympic Games – a milestone in an athlete's career.

Physiotherapy and physical education students noticed many barriers, for example, in the organization of their classes: the inability to take part in practical activities, live demonstrations of physiotherapeutic methods and motor exercises by lecturers [16]. Students' physical activity during isolation was mostly based on their previous experience in performing exercises and the knowledge of a healthy lifestyle. This helped them to adapt to the isolation regime, maintain the optimal level of physical activity and life satisfaction. During the pandemic, physiotherapy students were more aware of the nature of the disease, the need for protection and the rules of physiotherapeutic tasks when dealing with sick people [17].

The return of sport activity after the "coronavirus holidays" was a reason to wonder how much the pandemic will affect the industry and the return of habitual physical activity. All representatives of the sports world were waiting for the quick resumption of the usual way of organizing events. At the same time, expert assessments did not provide clear forecasts about the time of full recovery of the sports sector affected by the consequences of the COVID-19 pandemic. Also, the health effects of this still new and not fully understood infection have not yet been sufficiently researched and recognized.

Physical activity and the related life satisfaction are the earliest responsive measures of health behaviours that reflect the dynamics of life activity and adaptation to changes in external environment [10]. Due to the fact that PE students and future physiotherapists are representatives of educational areas significantly affected by anti-pandemic restrictions, and because they know how to regain the appropriate level of physical activity, the authors considered it justified to conduct research in this group in the final phase of the pandemic.

AIM

The main objective of this study was to assess the PA level and motivation declared by students, as well as to evaluate their life satisfaction at the close of the COVID-19 pandemic.

MATERIALS AND METHODS

The cross-sectional study was conducted in the period of October-November 2022 as part of an international multi-centre research project, in which the consequences of the COVID-19 pandemic were recognized as the main factors influencing the lives of students. Before starting to complete the questionnaire, all participants were informed about the objectives, methodology and anonymous, confidential nature of the study. An invitation to participate in the online survey was disseminated through targeted advertising, including the e-learning platform (Moodle), Microsoft Teams and university social networks. The respondents gave their informed consent to participate in the survey, and thus to provide sociodemographic data (gender, field of study, place of residence, etc.). The research tool was the Polish version of generally accepted standardized questionnaires. The inclusion criteria were as follows: consent to participate in the study, providing all answers to the survey questions, and no contraindications to engage in physical activity, including health contraindications related to the COVID-19 disease.

STUDY PARTICIPANTS

The sociological research was conducted among students of Physiotherapy and Physical Education from several partner universities in Eastern Poland. In total, there were 211 respondents, including 105 future physiotherapists (Group 1) and 106 future PE teachers (Group 2) from the universities in Biała Podlaska and Białystok. Among the representatives of both groups, the majority were men: 66.7% and 72.6%. The students generally lived in a large city. The age of the respondents did not differ statistically between the groups (22.8 ± 2.23 vs. 22.9 ± 2.0 years).

STUDY DESIGN AND PROCEDURE

A diagnostic survey method was applied using several research tools. They were used to assess the level of physical activity. The International Physical Activity Questionnaire – Short Version (IPAQ-SF) consists of seven questions regarding the type of physical activity in everyday life over the last seven days and time devoted to intense and moderate physical activity, walking and sitting. The level of physical activity is presented in MET-min/week (metabolic equivalent of 1 MET is defined as the amount of oxygen consumed when sitting at rest. This equates to 3.5 ml O_2 per kg body weight/min). For walking, the MET value is equal to 3.3, during the moderate activity it is 4.0, and

for intense activities the number is converted by the MET value of 8.0. According to the IPAQ scoring protocol, there are three levels of physical activity, i.e. low, moderate and high [18]. In the study, internal consistency for the IPAQ-SF questions – Cronbach's alpha was 0.745.

The next questionnaire – Inventory of Physical Activity Objectives (IPAO) was developed by M. Lipowski and Z. Zaleski (2015) [19]. It consists of five modules containing questions to asses such variables as: variety of forms, volume, and frequency of physical activity. For 12 goals, the Likhert scale (1-5) is provided, and the respondent is asked to determine the extent to which the selected PA goals are important. Ultimately, the following scales were distinguished: 1) motivational value (the strength with which goals influence an individual to take actions); 2) time management (the level of focus on planning, organizing and devoting time to PA); 3) perseverance in action (effectiveness and durability of actions and coping with adversities); 4) motivational conflict (the level of contradiction: physical activity goals vs. other goals). Cronbach's alpha was used to verify internal consistency of the questionnaire; it was 0.902 for IPAO.

The Satisfaction with Life Scale (SWLS) developed by Diener et al. [20] includes five statements with which respondents agree or disagree in relation to their life. The score generally indicates life satisfaction manifested by a sense of satisfaction with one's achievements. Internal consistency was 0.844 (Cronbach's alpha).

The study was conducted in accordance with the Declaration of Helsinki. The Bioethics Committee of the Medical University of Białystok, Poland (Resolution number: APK.002.1932.2022) approved the protocol of the study. A permission to conduct an anonymous survey among the students was obtained from the authorities of the universities participating in the research. The authors of the survey did not collect any identifiable information from the participants.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistica 13 (Tibco Inc., USA). The Shapiro-Wilk test was applied to assess the normality of distribution. Arithmetic mean (M), median (Me) and standard deviation (SD), as well as Q_{75}-Q_{25} and interquartile range (IQR) were calculated. Difference analysis was conducted using the independent samples t-test or non-parametric Mann-Whitney U test, depending on the normality of distribution. Pearson's chi-squared test was used for comparative assessment. Correlations between qualitative variables were calculated using the Spearman's correlation coefficient, which measures the strength and direction of the relationship between variables. Interval estimation of statistical parameters was determined using the 95% confidence interval. A significance level of $p < 0.05$ was assumed in all analyzed cases.

RESULTS

Taking into account the purpose and methodology of the study, the analysis of the results began with determining the levels of physical activity demonstrated by students of physiotherapy and physical education – in accordance with the IPAQ-SF methodology (Table 1).

More than half of the students demonstrated a high level of PA. Among physical education students, this percentage exceeded 80%. Among the future physiotherapists there were students with a low level of PA, which was not the case among the students from Group 2. The strength of the relationship between group membership and the level of physical activity was at the level of Spearman's average correlation (r=0.34, p<0.05). The PA level for both groups was 4289.4±3635.0 MET-min/week. The division of PA levels by group membership and gender is presented in Table 2.

The results of the analysis of weekly time devoted to PA indicate that intense physical activity for 3 days and more was rarely declared by the respondents (only by 42.9% of future physiotherapists and by 73.6% of physical education students). Moderate PA undertaken at least 3 times a week was declared by 68.6% of the respondents from the first group and by 81.1% of the respondents from the second group. Walking was the third type of analyzed activity. This activity was indicated by 90.5% and 95.3% of the respondents, respectively.

The total level of PA by field of study and gender is presented as percentage in Fig. 1. Assuming that gender may determine the level of PA, it was found that a higher percentage of men met the IPAQ-SF criteria for the highest level of PA – over half of the male respondents from the first group and 83.1% from the second group.

Table 1. The level of physical activity in students from both groups (IPAQ-SF)

PA Levels	Groups		Total (N=211)	Mann-Whitney test Groups 1 vs 2	p
	Students - future physiotherapists (Group 1) (N=105)	Physical education students (Group 2) (N=106)			
	N (%); 95-percent confidence interval - 95%CI			U (Z)	
Low	12 (11.4); 5.3-17.2	0	12 (5.7); 5.0-6.4	3739 (-4.12)	<0.001
Moderate	40 (38.1); 28.8-47.4	20 (18.9); 11.5-26.4	60 (28.4); 22.3-33.4		
High	53 (50.5); 40.9-60.0	86 (81.1); 73.7-88.6	139 (65.9); 59.5-72.3		

Table 2. Descriptive statistics of the main types of PA in students from both groups, taking into account gender

Physical Activity	Group	Gender	M±SD	Me, IQR	Group total, M±SD, Me, IQR	U-Mann-Whitney test, U; p	
Intensive	Physiotherapy students (1)	Male (3)	1475±1971	960, 1520*	1347.4±1226.7, 720, 1320	3711.5; $p_{(1-2)}$ <0.001	NS
		Female (4)	1091±1345	640, 480**			
	Physical education students (2)	Male (3)	2467±2070	2400, 2560	2233.9±1484.7, 1920, 2480		832.5, $p_{(3-4)}$ <0.05
		Female (4)	1614±1491	1440, 1920			
	Total			1793±1921, 1200, 2400			
Moderate	Physiotherapy students (1)	Male (3)	878±1409	420, 780*	879.4±829.8, 400, 760	3679.5; $p_{(1-2)}$ <0.001	NS
		Female (4)	882±1302	360, 960**			
	Physical education students (2)	Male (3)	1382±1473	840, 1200	1258.9±893.2, 840, 1200		NS
		Female (4)	932±776	800, 720			
	Total			1070±1360, 600, 900			
Walking	Physiotherapy students (1)	Male (3)	1093±1056	660, 594*	1137.1±938.8, 660, 660	3965.1; $p_{(1-2)}$ <0.001	NS
		Female (4)	1226±1514	693, 968**			
	Physical education students (2)	Male (3)	1653±1949	924, 1485	1713.7±1367.6, 924, 1480		NS
		Female (4)	1874±2060	1040, 1386			
	Total			1427±1791, 792, 924			
Total physical activity	Physiotherapy students (1)	Male (3)	3446±3883	2027, 3320*	3363.6±2470.7, 2175, 3157	3276.5; $p_{(1-2)}$ <0.001	NS
		Female (4)	3199±2598	2346, 3612**			
	Physical education students (2)	Male (3)	5503±3628	4810, 3451	5206.5±2659.0, 4327, 3491		NS
		Female (4)	4420±3271	3960, 2586			
	Total			4289±3635, 3246, 4121			

*Note: *Groups: physiotherapy students (1) and physical education students (2). **Groups: male (3) and female (4); p-test probability value calculated using the Mann-Whitney test. Differences by gender are statistically significant (p<0.01).*

Among the women, 48.6% of physiotherapy students and as many as 75.9% of physical education students had a high level of PA. The same ratio (1:1.6) was typical for men.

The goals of physical activity were analyzed using the IPAO. At the beginning, the respondents answered questions about their current and past competitive sports. Only 50.5% of physiotherapy students and 93.4% of physical education students declared that they currently practice competitive sports. In the past, such activity involved an additional 24.0% of physiotherapy students and 6.6% of PE students. This was confirmed by a significant relationship between the practice of competitive sports and group membership (r=0.48, p<0.05).

At the close of the pandemic, an atmosphere in the respondents' family was encouraging (mobilizing) for physical activity. However, this level can be described as low – 2.87±1.24 points (with the maximum possible grade of 5.0) among physiotherapy students and 2.98±1.17 among physical education students (p>0.05). In the professional environment, an atmosphere was more encouraging to take up physical activity in the group of PE students (3.19±1.28) than among future physiotherapists (2.82±1.28) (p<0.001). At the close of the pandemic, good conditions for physical activity, availability of fitness clubs and natural conditions for practice were declared at a level of more than 3.0 points out of 5.0 (similar values for physiotherapy students 3.36±1.28 vs. 3.51±1.30 for PE students (p>0.05)). Generally, as expected, a higher level of activity-related behaviours was presented by physical education students.

The respondents were also asked to indicate to what extent (on a scale from 1 to 5), the goals of physical activity are important to them. Statistical differences in the choice of goals treated as a priority by PE students compared to the first group of respondents were as follows: physical fitness, good condition, slim figure (beauty, appropriately "ripped" body and body firmness), pleasure from physical activity, escape from everyday life and satisfying the need for exercise. This also included PA as a health-promoting behaviour by setting a good example, which is very important from the educational perspective (Table 3).

Care for health was indicated as the main goal of engaging in physical activity (41.9% and 28.3%, respectively). The second important goal was the pursuit of physical fitness and good condition (15.2% and 24.5%, respectively), the third place was taken by the pursuit of aesthetics through a slim figure (beauty, appropriately "ripped" body and body firmness) (12% each), and the fourth priority – well-being (15.2% and 10.4%, respectively). As for gender, women from group 1 more frequently chose physical activity for maintaining and care for health. In the case of female PE students, the following goals turned out to be important: building self-esteem, gaining recognition in the eyes of others and promoting PA by setting a good example, also escaping from everyday life and relieving stress. No

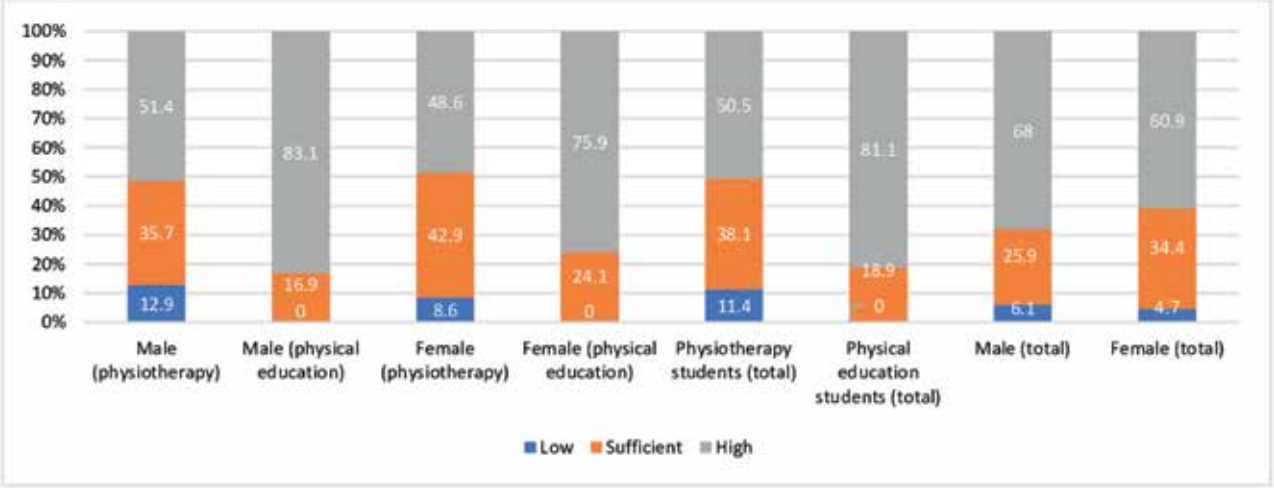

Fig. 1. The level of PA was classified as low, moderate and high by gender for both groups (%).

statistically significant relationships were found between the field of study and: time management (planning and organizing time for physical activity); perseverance in action (effectiveness of actions and coping with difficulties encountered during physical activity); or motivational conflict – the level of contradiction between the selected goal and other goals. Only the motivational value – the strength with which goals influence the activities undertaken by an individual – differentiated the students; the value was higher in physical education students (Table 4).

SATISFACTION WITH LIFE SCALE (SWLS)

The results of the SWLS scale reveal that PE students were the most satisfied with life. In this group, the score was 25.4±5.45 (Me=26.0) and it was statistically higher than that of future physiotherapists (23.5±5.95) (Me=24.0). Extreme dissatisfaction with life or its high degree was recorded in a small number of cases (not exceeding 5%). A neutral answer, i.e. neither dissatisfaction nor satisfaction with life, was noted in 7.1% of the respondents. Moderate and high life satisfaction was reported in 33.2% and 27.0% (among PE students this value is the highest and amounts to 28.3% vs. 34.9%; among the men and women from group 1 – 38.1% vs. 19.9%. A shortened three-level scale of life satisfaction with division into low, medium and high is presented in Table 5.

In group 1, the score was more favorable in women. Students from group 2 obtained higher results compared to their peers from group 1, but the outcomes did not differ significantly depending on gender. The average life satisfaction for all students was 24.4±5.77 (Me=25). The maximum life satisfaction was declared by more than half of the respondents (58.2%); among physical education students this value reached 64.2%. A slightly lower value was found in group 1 (52.4%). Differences between groups were statistically significant and resulted mainly from differences between men ($p<0.01$).

DISCUSSION

The paper presents the results of the assessment of the level of physical activity and motivation declared by students of physiotherapy and physical education at the close of the COVID-19 pandemic. The authors also determined the level of life satisfaction of the respondents. Adults and adolescents, who meet the minimum physical activity criteria of 150 minutes of moderate activity or 75 minutes of vigorous activity per week, are less likely to experience health problems (physical and mental) compared to those who do not meet these criteria [21]. The results of the study show that the majority of the respondents, regardless of their field of study, are sufficiently active and try to maintain the optimal level of physical activity. However, every tenth physiotherapy student did not meet the criteria for moderate or high PA level. According to Cooper, this may indicate that physical activity, as a coping technique and protective mechanism, can contribute to reducing the likelihood of experiencing, among others: sadness and mental disorders in stressful situations [22]. In our opinion, this is especially important in post-pandemic times, when modern society is struggling with numerous problems with physical and mental health, especially in the population of young people [23].

Given the above, there is an increasing interest in research on the motivation to engage in physical activity and being physically active. Motivation can be most simply defined as the tendency of people to do something for a purpose. According to Ryan and Deci [24], motivation corresponds to the state of energization and activation of the body in a social context and is perceived as a multidimensional construct characterized not only by intensity, but also the type of motive [25]. The study focuses on the motivation for engaging in physical activity. Good conditions and motivation to engage in physical activity were declared at the level of 3.0-3.5 points out of 5.0 (with a predominance of PE students). No statistically significant differences were found between the field of study and time management, persistence in action and motivational conflict. Only the motivational value – the strength with which goals influence the activities undertaken by an individual – differentiated the students; the value was higher in physical education students. The authors of this

Table 3. Prioritization of physical activity goals among the respondents

Purpose of using physical activity	Group, M±SD (Me)				Total		Mann-Whitney test, U (Z)	P (<)
	Group 1		Group 2					
	Male (N=70)	Female (N=35)	Male (N=77)	Female (N=29)	Male (N=147)	Female (N=64)		
1. Health (right levels of: blood pressure, cholesterol, body mass, etc.)	3,60 ±1.31 (4.0)	4,20±0.96* (4.0)	3,95±1.22 (4.0)	3,83±1.17 (4.0)	3,78±1.27 (4.0)	4,03±1.07 (4.0)	5237 (-0.7)	0,46
	3,80±1.24 (4.0)		3,92±1.20 (4.0)		3,86±1.22 (4.0)			
2. Physical fitness, being 'in shape'	3,73±1.26 (4.0)	3,97±1.01 (4.0)	4,09±1.18 (4.0)**	4,14±0.99 (4.0)	3,92±1.23 (4.0)	4,05±1.0 (4.0)	4664 (-2.0)	0,04
	3,81±1.19 (4.0)		4,10±1.13 (4.0)		3,96±1.16 (4.0)			
3. Company of other people	3.43±1.22 (4.0)	3.40±1.29 (4.0)	3,61±1.29 (4.0)	3,69±1.11 (4.0)	3,52±1.26 (4.0)	3,53±1.21 (4.0)	5029 (-1.2)	0,23
	3,42±1.24 (4.0)		3,63±1.24 (4.0)		3,53±1.24 (4.0)			
4. Fit, shapely body (beauty, sculpted and firm body)	3,56±1.26 (4.0)	3,86±0.97 (4.0)	4,05±1.13 (4.0)**	4,07±0.84 (4.0)	3,82±1.22 (4.0)	3,95±0.92 (4.0)	4456 (-2.5)	0,01
	3,66±1.18 (4.0)		4,06±1.06 (4.0)		3,86±1.13 (4.0)			
5. Wellbeing	3,84±1.11 (4.0)	4.23±1.0 (4.0)	4,09±1.09 (4.0)	4,24±0.83 (4.0)	3,97±1.10 (4.0)	4,23±0.92 (4.0)	5084 (-1.1)	0,28
	3,97±1.09 (4.0)		4,13±1.02 (4.0)		4,05±1.06 (4.0)			
6. Being physically active and fit according to fashion	2,89±1.36 (3.0)	2,66±1.28 (3.0)	2,99±1.47 (3.0)	3,34±1.14 (3.0)***	2,94±1.42 (3.0)	2,97±1.26 (3.0)	4938 (-1.4)	0,16
	2,81±1.33 (3.0)		3,08±1.39 (3.0)		2,95±1.37 (3.0)			
7. Boosting confidence, gaining appreciation from others	2,84±1.35 (3.0)	2,37±1.17 (3.0)	2,94±1.33 (3.0)	3,34±1.23 (3.0)***	2,89±1.34 (3.0)	2,81±1.28 (3.0)	4728 (-1.9)	0,06
	2,69±1.30 (3.0)		3,05±1.31 (3.0)		2,87±1.32 (3.0)			
8. Pleasure from physical activity	3,50±1.33 (4.0)	4,03±1.01 (4.0)	4,01±1.13 (4.0)**	4,03±1.05 (4.0)	3,77±1.25 (4.0)	4,03±1.02	4692 (-2.0)	0,05
	3,68±1.25 (4.0)		4,02±1.10 (4.0)		3,85±1.19 (4.0)			
9. Escape from everyday life	3,21±1.31 (3.0)	3,34±1.19 (3.0)	3,57±1.14 (4.0)	3,97±1.02 (4.0)***	3,40±1.23 (4.0)	3,62±1.15 (4.0)	4506 (-2.4)	0,02
	3,26±1.26 (3.0)		3,68±1.12 (4.0)		3,47±1.21 (4.0)			
10. Managing stress	3,59±1.19 (4.0)	3,60±1.19 (4.0)	3,62±1.20 (4.0)	4,03±1.05 (4.0)***	3,61±1.19 (4.0)	3,80±1.14 (4.0)	5147 (-0.9)	0,35
	3,59±1.18 (4.0)		3,74±1.17 (4.0)		3,66±1.18 (4.0)			
11. Fulfilling the need for activity	3,39±1.33 (4.0)	3,89±1.08 (4.0)	3,95±1.09 (4.0)**	4,00±0.96 (4.0)	3,68±1.24 (4.0)	3,94±1.02 (4.0)	4590 (-2.2)	0,03
	3,55±1.27 (4.0)		3,96±1.05 (4.0)		3,76±1.18 (4.0)			
12. Promoting PA by setting a behaviour example	2,93±1.35 (3.0)	3,06±1.21 (3.0)	3,56±1.22 (4.0)**	3,72±1.0 (4.0)***	3,26±1.32 (3.0)	3,36±1.16 (4.0)	4048 (-3.4)	0,001
	2,97±1.30 (3.0)		3,60±1.16 (4.0)		3,29±1.27 (3.0)			

*Note: *differences in the group by gender are statistically significant (p<0.05); **differences in groups by gender (men) are statistically significant (p<0.05); ***differences in groups by gender (women) are statistically significant (p<0.05).*

original methodology claim that greater knowledge about the purposefulness of activities among physical education students supports and shapes additional individual motivation by setting new, realistic goals [19].

Life satisfaction affects well-being. During the COVID-19 pandemic, students were exposed not only to changes related to online education, loss of interaction with peers and social ties, but they also faced the inability to participate in practical classes. There are concerns and research evidence that the consequences of the pandemic could seriously impact students' life satisfaction. This is confirmed by the results of the research conducted by Herbert et al. [26] during the first wave of the

Table 4. Interpretation of the four modules according to the theory of motivational function of goals

Modules	Group, M±SD (Me)				Total		Mann-Whitney test, U (Z)	P (<)
	Group 1		Group 2					
	Male (N=70)	Female (N=35)	Male (N=77)	Female (N=29)	Male (N=147)	Female (N=64)		
Motivational value	3,80±0.82 (3.75)	3,65±0.86 (3.6)	4.11±0.71 (4.3)**	3.88±0.79 (4.0)	3.97±0.78 (4.0)	3.76±0.84 (3.9)	4349 (-2.74)	0,01
	3,75±0.84 (3.75)		4,05±0.74 (4.25)		3.90±0.80 (4.0)			
Time-management	3,41±0.90 (3.4)	3,17±0.99 (3.0)	3.64±0.82 (3.6)	3.43±0.88 (3.6)	3.53±0.86 (3.4)	3.28±0.95 (3.2)	4791 (-1.75)	0,08
	3,33±0.93 (3.40)		3,58±0.84 (3.40)		3.46±0.89 (3.40)			
Persistence in action	3,12±1.0 (3.0)	2.73±0.92 (2.7)*	2.90±1.03 (2.7)	2.93±1.0 (3.0)	3.0±1.02 (3.0)	2.82±0.96 (2.8)	5217 (0.78)	0,43
	2,99±0.99 (3.0)		2,91±1.02 (2.83)		2.95±1.0 (3.0)			
Motivational conflict	3,46±0.80 (3.5)	3,44±1.21 (3.5)	3.77±1.01 (4.0)	3.5±0.95 (3.5)	3.62±0.96 (3.5)	3.47±1.09 (3.5)	4895 (-1.51)	0,13
	3,46±0.99 (3.5)		3,69±1.0 (3.5)		3,58±1.0 (3.5)			

*Note: *differences in the group by gender are statistically significant (p<0.05); **differences in groups by gender (men) are statistically significant (p<0.05).*

Table 5. SWLS scores for the three groups of students

Groups of Students	Gender	SWLS (Points)	SWLS		
			Low	Moderate	High
		M±SD (Me)	Scores n, (%)		
			5-17	18-23	24-35
1	Male	23.0±6.14 (24.0)*	10 (14,3)	24 (34,3)	36 (51,4)
	Female	24.6±5.47 (24.0)	3 (8,6)	13 (37,1)	19 (54,3)
	Total	23,5±5.95 (24.0)	13 (12.4)	37 (35.2)	55 (52.4)
2	Male	25.4±5.61 (26.0)	6 (7,8)	22 (28,6)	49 (63,6)
	Female	25.3±5.52 (25.0)	2 (6,9)	8 (27,6)	19 (65,5)
	Total	25,4±5.45 (26.0)	8 (7.5)	30 (28.3)	68 (64.2)
Total	Male	24.2±5.96 (25.0)	16 (10,9)	46 (31,3)	85 (57,8)
	Female	24.93±5.31 (24.5)	5 (7,8)	21 (32,8)	38 (59,4)
	Total	24,4±5.77 (25.0)	21 (10.0)	67 (31.8)	123 (58.2)
$p_{[male\ [1,\ 2]} < 0.01\ p_{[female[1,\ 2]} > 0.05; p_{[total[\ 1,\ 2]} < 0.01$					

*Note: *differences in the group by gender are statistically significant (p<0.05).*

pandemic and lockdown in 2020. According to the authors, compared to the studies conducted before the pandemic, low levels of life satisfaction, depression and anxiety were significantly more evident. Similar results were reported in other countries affected by lockdown [27]. Our study adds an important perspective to the discussion on satisfaction of physical education students and medical students with life after the COVID-19 pandemic. Therefore, further research is needed to assess the impact of physical activity on young people's personal and professional life satisfaction and their desire to optimize physical activity in a targeted way.

CONCLUSIONS

The COVID-19 pandemic has had a negative impact on the level of physical activity and the sense of life satisfaction. At the close of the COVID-19 pandemic, the specificity of the fields of study, i.e. PE and Physiotherapy, and gender turned out to be variables having a significant impact on the resumption, type and reasons for undertaking physical activity, and consequently improving life satisfaction. PE students' perception of the importance of physical activity was more pronounced than that of physiotherapy students, which is a strong enough factor to increase life satisfaction in this group of students.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Assessment of damage to the physiotherapist's thumb when working on trigger points: an analysis of its performance and comparison to tool therapy

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ABSTRACT

Aim: This study aims to assess the behaviour of the thumb when subjected to axial pressures, to estimate the risk of potential damage in the long term and to quantify the information obtained from clinical analyses.

Materials and Methods: The study evaluated the effect of axial loading on the thumb based on an objective assessment during measurements on a strain gauge bench and compared it to hand loading during use of a fascial therapy tool. The study was supplemented by biomechanical analysis on an X-ray of a randomly selected physiotherapist.

Results: The study highlighted a decrease in thumb performance during the course of successive soft tissue therapy techniques, despite guidelines stating the need for uniform action on the tissues, and confirmed that prolonged axial pressure/loading can lead to a range of functional impairments carrying the risk of permanent damage in the long term. Compared to thumb work, tool therapy scored slightly better, although also with a downward trend indicative of inadequate ergonomics resulting from the tool's design.

Conclusions: The thumb, as the most sensitive structure of the therapist's hand, despite anatomical conditions providing it with high stability during use, can gradually acquire dysfunctions that limit its performance. Consequently, there is a need to search for substitutes that are as equally effective.

KEY WORDS: treatment, pain, thumb, fascia, M-Stick

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INTRODUCTION

Therapy through palpation and direct stimulation of the body's shells is a significant part of science of therapeutic physiotherapy. Treatment methods involving direct interference with soft tissue structures through pressure application and correction of tissue anomalies lead to fibrosis and improvement of tension tensegrity, and reduction of pain sensations [1]. As the majority of the techniques are performed with the therapist's hand, there is a risk that this may lead to degradation of the specialist's hand structures, especially in the thumb region, over an extended period of time.

There are a number of studies analysing thumb injuries resulting from soft tissue damage due to overloading in anatomical planes of movements [2]. Hand injuries account for up to 29% of all cases that show up in emergency departments [3]. The most common of these, apart from bone injuries, is injury to the Ulnar Collateral Ligament of the thumb (Ulnar Collateral Ligament) as a consequence of sudden uncontrolled hyperextension, commonly referred to as 'Skier's Thumb' [4].

Most of the available studies focus on injuries following uncontrolled deepening of ranges of motion with an associated low-amplitude, high-impact force component under conditions of forced hyperabduction in sports such as skiing, football and basketball [5]. These phenomena fall within the space and directions consistent with the functional anatomy of joints. However, it is noted that little analysis is available on such a non-specific use of the thumb as the controlled axial load exerted by the pad during the development of patient soft tissue trigger points.

The essence of the thumb's broad dexterity is its articular structure, the most significant of which is the carpometacarpal joint (CMC), which is concave-convex in shape. Its two cartilaginous surfaces have the shape of a saddle6 formed by the fusion of the greater quadrilateral bone and the first metacarpal bone. Thanks to this structure, the CMC joint has flexion and extension as well as adduction and abduction mobility and is a very mobile yet stable joint [6,7].

The CMC joint is passively isolated by the dorsal radial ligament complex (DRL), dorsal central ligament (DCL) and posterior oblique ligament (POL). The ligaments of the CMC are significantly stronger dorsally and thin volumetrically on the palmar side in terms of both thickness and cellular content [8] which provides it with protection against subluxation. The other joints, i.e. metacarpophalangeal (MCP) and thumb interphalangeal (PIP), are characterised by more restricted freedom of movement at the expense of greater stability. Both joints have a hinge structure and mobility only around the lateral axis [7].

Among the passive structures of this area of the thumb that act as stabilisers and load transmitters in the context of axial pressure and load in abduction, one of the most important is the ulnar collateral ligament of the thumb (UCL). It has mainly a protective role for the metacarpophalangeal joint of the thumb [9]. It prevents subluxation of the proximal phalanx, and its rupture leads to loss of the ability to hold objects and clench the fist with the thumb [10].

The volar plate, located on the palmar side of the thumb interphalangeal (PIP) joint capsule, is also an important structure in overstretch injuries. The volar plate is a connective tissue structure into which the flexor tendon fits, together forming a system that prevents the joint from overpronating. The palm plate contributes to the stability of the PIP in the anteroposterior plane and prevents overpronation of this joint [11]. It provides protection mainly in sports like mountain climbing, requiring a strong grip and overloading of the finger joints. As the main mechanism of VPI injury is overpronation, it should be considered in all finger injuries [12].

However, dislocations of the thumb VPI joint are very rare due to its inherent stability. They only occur following axial loading of an over-erect finger or a combination of rotational deformity force and hyper-extensile injury [13].

The anatomical conditions of the thumb under normal conditions allow it to work in the following ranges of mobility:

- carpometacarpal joint – art. carpometacarpea pollicis – flexion/extension 70-0-0
- abduction/adduction 70-0-0 [14]
- metacarpophalangeal of the thumb – art. metacarpophalangeae – flexion/extension 0-0-50
- interphalangeal thumb – art. interphalangea pollicis – flexion/extension 0-0-80 [15].

Despite this, it is difficult to clearly determine when true thumb joint flaccidity is present, as some studies show that these norms can vary from person to person and even from one side of the body to another. 34% of those assessed showed more than a 10-degree difference in extension and 12% – a 15-degree difference between the left and right sides at the metacarpophalangeal joint of the thumb [16].

It is an indisputable fact that a chronic form of UCL failure, which is referred to in the literature as Forester's Thumb [17], can develop in the thumb subjected to regular abduction overload, whereas with complete rupture of this structure, the most effective method is surgical treatment with soft anchors, which, according to analyses, provide high patient satisfaction and low complication rates [18].

AIM

The present study aims to assess the behaviour of the thumb when subjected to axial pressures, to estimate the risk of potential damage in the long term and to quantify the information obtained from clinical analyses. At the same time, the performance of the thumb will be compared with an alternative tool therapy using the M-Stick, a prototype thumb simulator.

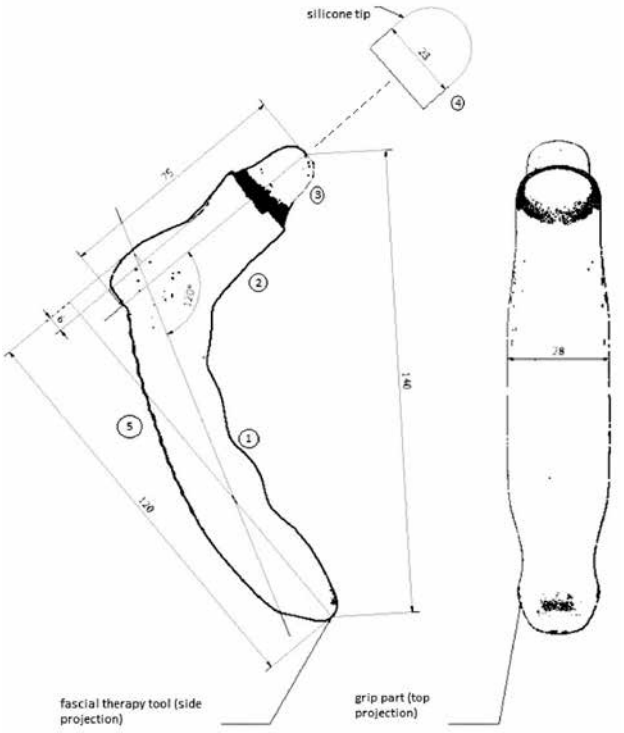

Fig. 1. M-Stick prototype fascial therapy tool.

MATERIALS AND METHODS

The subject of the study was the analysis of the thumb's therapeutic capabilities, which included the evaluation of the average dynamic load under constant test conditions on a strain gauge platform and any anomalies occurring during the test. The evaluation of the thumb's load and force was compared with the load generated during tool therapy using the M-Stick prototype technology, a device created for the study, made with 3d technology from ABS filament (Fig. 1). In construction, it is presented as a manipulator with a slightly curved line giving an angle of 120° between the gripping part and the therapeutic part at the end of which there is a spearhead acting on soft tissues, made of molding silicone, simulating with density the sensation as if working with the thumb. The tool, through a steady grip with the hand and acting on tissues in the region of local fascial elasticity abnormalities, was designed to perfectly replicate traditional soft tissue loading with the therapist's thumb, negating patient discomfort and sustaining efficacy as in tool-free therapy.

As the study used technology never before used in clinical assessment, all references to the literature were drawn from other tool methods known to science, with the indication that these links were treated as ancillary, but not finding close correlations due to the diametrically different in design, tools used during the study.

RESEARCH METHODOLOGY

The study was based on a standardized observation method, using Temporal Sample Observation Techniques at short intervals. The essence of the study was an objective,

quantitative assessment of the loads on the test structures using measurement tools created for this purpose [19]. In the first part of the study, a group of physiotherapists who subject their hands to specific loads on a daily basis were tested in order to collect data on the loads to which the thumb is subjected during soft tissue work. Working with patients with methods , the core of which are fascial techniques and their derivatives. The test consisted of compressing 3 times with the thumb pad a field simulating the structure and density of soft tissues, on a strain gauge tool built for this purpose, referred to in science as a resistive measuring transducer , which converts the linear deformation of the test object into a change in its resistance [20]. A single compression lasted 60 seconds during which the device recorded the level of load exerted by the thumb at a frequency of 2Hz. The main condition during the test was to simulate the load exerted on soft tissues by therapists in the course of their work, with posture and hand positioning identical for real therapy.

The second part of the study consisted of an auxiliary X-ray of the hand of one of the randomly selected therapists participating in the first part in three versions:

1. A photograph of the hand at rest, with the wrist and thumb in position as for soft tissue therapy.
2. A photo of the hand subjected to axial loading in the thumb axis with a force such as the averaged force from part one of the study.
3. photograph of the hand using the M-Stick,

The X-ray was taken as an objective auxiliary tool to visualize the biomechanical relationships associated with axial loading of the thumb with the assumption that any thumb subjected to loading would experience similar physical phenomena. Due to regulations justifying X-ray examinations only in legitimate medical cases, only one image was taken after a physician's referral, as illustrative information for evaluating the potential behavior of the hand bones during various loads applied during soft tissue therapy. The photograph taken as part of the study was thoroughly analyzed in terms of the positioning of individual hand bones in space, and biomechanical evaluation of the loads they are subjected to during work in order to create a visualization of overload factors predisposing to hand diseases.

STUDY GROUP

The study group consisted of 50 physiotherapists using Soft Tissue Techniques of Fascial Therapy in therapy with patients. The group was selected without gender criteria, with an age range of up to 40 years. The rationale for the upper age limit was to minimize the likelihood of permanent degenerative changes in the thumb joints that are a component of natural tissue degeneration processes and overload resulting from the nature of work with patients.

INCLUSION AND EXCLUSION CRITERION

The inclusion criterion was to have the knowledge necessary to perform Fascial Therapy, to implement it on a daily basis, and a minimum of 1 year of experience in soft tissue work involving thumb loading techniques.

Exclusion criteria were work with patients not involving soft tissue techniques, current inflammation, and other conditions of the thumb currently or in the past that prevented testing or could significantly affect the results.

STATISTICAL ANALYSIS

Statistical analysis was prepared using STATISTICA v.13. Responses to qualitative questions were presented as percentages. For quantitative variables, descriptive statistics (arithmetic mean, minimum and maximum value) were calculated. In order to detect statistically significant differences due to selected characteristics of respondents, a non-parametric test for dependent samples was applied: the Wilcoxon paired rank order test. The correlation test was performed using Sperman rank correlation, analyzing variables that were outliers of the study due to limited data. A significance level of p=0.05 was used in all cases analyzed.

RESULTS

According to the results of the test on the strain gauge device, an average load on the therapist's thumb is 7.95 kg/cm^2. It is extremely vital that during the 1-minute load, the pressure force decreases steadily, by up to 34,16% from the initial state (Fig. 2). In subsequent trials, a decrease in load was observed in both its maximum ranges (12.03kg, 8.46kg, 8.25kg) and minimum ranges (7.54kg, 5.9kg, 5.6kg) (Table 1). The averaged measurement was stripped of the first 2 seconds of compression, due to the fact that therapists referred to this stage as an attempt to position the hand as optimally as possible rather than the actual therapy. The optimal duration of the applied pressure, patient position and frequency of treatments are not currently clearly described or defined in the literature, but it is accepted that the pressure exerted during therapy should be constant so that the therapy does not give a false sense of improvement induced by the reduced pressure on the tissues during the technique.

The 3 compression trials in the test produced a constant decrease in the intensity for each successive attempt (Fig. 3), which proves that the reduction in tissue load during operation is inevitable and is not due to the physiotherapist's deliberate offloading of the thumb. Instead, it may be caused by its partial fatigue. When working with a larger number of patients, the magnitudes are likely to decrease. Another characteristic of the therapy are the rising waves described as Waves A, B and C, which are visible in the first measurement, at the 2nd, 30th and 44th seconds, but in the subsequent measurements only Wave A remains, determining the initial pressure adjustment for the whole trial. The other waves do not appear in the second and third trial and the entire line of trial 2 and 3 flattens out with a slight downward trend, which allows for concluding that, when working on tissue of identical density, there is a constant balancing of work intensity striving to match the elasticisation dynamics of the patient's soft tissues.

In comparison, during the M-Stick tool test, the average load was 8.97kg/cm^2. However, during it too, a gradual decrease in load was obtained from a maximum level of 96N to 79N, which indicates not so much an aggravation

Table 1. Level of forces generated in each test and averaged data

	Test 1		Test 2		Test 3		Average	
Maximum load	118N	12,03kg	83N	8,46kg	81N	8,25kg	94,0N	9,58kg
Minimum load	74N	7,54kg	58N	5,9kg	55N	5,6kg	62N	6,32kg
Average load	96N	9,78kg	71N	7,23kg	68N	6,93kg	78N	7,95kg
Load drop level after 60 seconds	44N	4,48kg	26N	2,65kg	26N	2,65kg	32N	3,26kg
Percentage of load drop after 60 seconds	37,22%		30,95%		32,09%		34,16%	

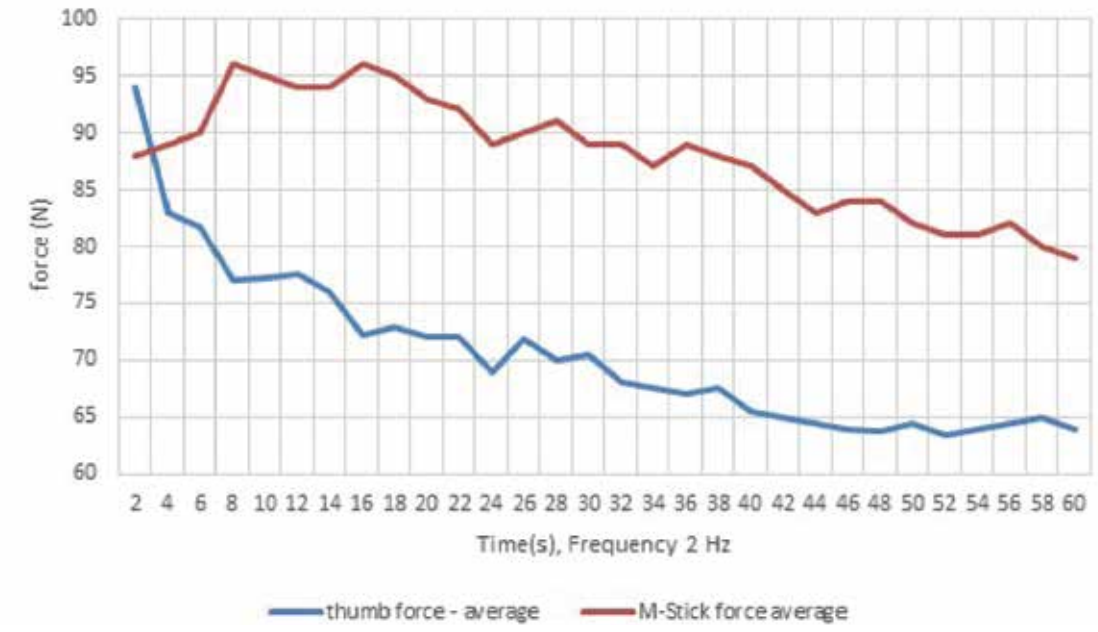

Fig. 2. Evaluation of the relationship between sustained force (F) and time (s) in 60-second thumb and M-Stick cycles.

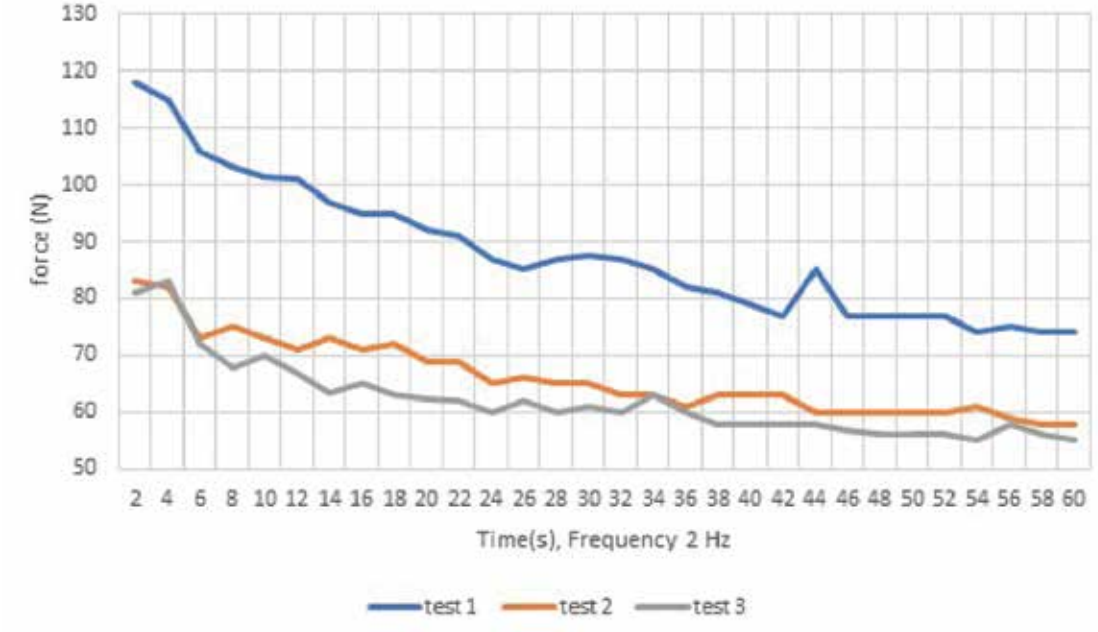

Fig. 3. Comparative evaluation of three consecutive pressure trials against time in 60-second cycles.

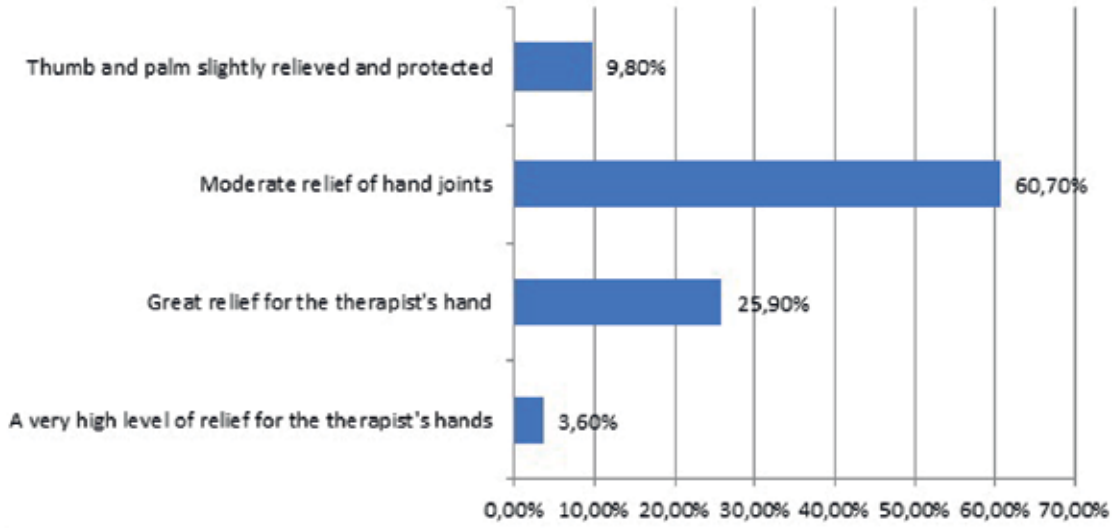

Fig. 4. Therapist's subjectively assessed level of hand joint relief during M-Stick use.

Fig. 5. X-ray projection of thumb space positioning without axial loading component (Written consent was obtained from the subject to perform radiological evaluation).

of hand fatigue as a gradual slight displacement of the hand along the grip of the tool (Fig. 4).

The difference in average load between the thumb and M-Stick pressure was 1.02kg in favor of the M-Stick, which seems obvious when eliminating the discomfort resulting from the constant axial load on the thumb.

The use of x-rays in a randomly selected therapist, on the other hand, as an objective diagnostic tool depicting biomechanical relationships, revealed a number of anatomical aspects of force transmission during measurements on the strain gauge bench. The images were taken with the therapist's hands working with mixed techniques, involving mainly fascial therapy at an intensity of about 15 patients per day in 30-minute sessions.

At rest, the physiotherapist's hand did not show any disturbing changes. In resting positions, no pathological symptoms were also recorded (Fig. 5). When the thumb was subjected to axial loading characteristic of fascial work with an average intensity of 7.5kg/cm^2 simulated with the most efficient alignment of the thumb, hand and forearm in terms of force transmission, a number of abnormalities of an overload nature were observed. The 1st metacarpal bone and proximal phalanx were pinned against the 2nd metacarpal bone and the flexed index finger to stabilise the CMC and MCP joints. On the other hand, the PIP joint, deprived of its stabilising component when loaded, lost its alignment capacity and adopted a pathological upright position reaching up to 45 degrees. (Fig. 6) This alignment did not cause pain until after several hours of work, and the reported complaints were centrally located within the PIP joint and disappeared as soon as the load was discontinued. The PIP joint was additionally subjected to a simple active range of motion test with a goniometer, with a result of 40-0-70. Given that functionally the thumb did not show signs of strength loss in compression, these results indicate acquired flaccidity rather than features of permanent damage to the palmar plate or ligamentous apparatus. However, similar findings indicate a high probability of worsening of the upright pathology, hypermobility of the PIP, and an increased risk of subluxation and future degenerative disease in this complex.

Fig. 6. X-ray projection of thumb alignment subjected to axial loading (simulation of soft tissue work) (Written consent was obtained from the subject to perform radiological evaluation).

Fig. 7. X-ray projection of thumb positioning while working with the M-Stick soft tissue therapy tool (Written consent was obtained from the subject to perform radiological evaluation).

In the last projection (Fig. 7), the M-Stick soft tissue therapy tool was used. The analysis shows complete relief of the thumb joints and distribution of compressive forces to the medial part of the hand joints. This type of therapy should, by definition, not cause symptoms of hand fatigue or pain, in addition to limiting the ability to assess palpation while working with the patient.

However, during the analysis, a subjective evaluation of the level of hand stress relief during M-Stick use on the strain gauge testbed was also performed, and only 3.6% of users rated M-Stick use as giving maximum hand joint relief. An overwhelming portion i.e., 60.7% of testers found that the M-Stick's design and sense of grip stabilization and force transfer in their subjective perceptions gave only moderate feelings of hand relief with an additional suggestion for further modifications to the grip portion of the M-Stick tool (Fig. 4).

DISCUSSION

The risk of pathology in the physiotherapist's hand is a rarely addressed issue in the literature and research. This is primarily due to the fact that physiotherapy is a relatively young field; that is, constantly being enriched by new treatment techniques. Consequently, a research group with conditions resulting from this type of overload is difficult to gather, and possible complaints are not always related to the nature of the work. According to the Central Statistical Office, 600,000 people in Poland benefited from inpatient and outpatient spa treatment in the year 2021 alone. Among the procedures performed, kinesitherapy accounted for 21 per cent, while in terms of individual procedures, more than 5 million procedures were performed[21]. This gives a partial view of the issues of the physical load on the physiotherapist's hands.

Evaluating the forces to which the thumb is subjected in the therapist's tactility, but also in other activities, is experimentally a difficult problem both in anatomical studies and those involving testing subjects, given the small size and anatomical complexity of the thumb, as well as the kinematic redundancy [16]. For this reason, it is difficult to predict with certainty how much force on the thumb pad is produced by each thumb muscle [22], and how accurately its loading forces are distributed during axial pressure given the set of stabilising and force-transmitting soft structures.

Partially helpful in possible analyses may be the results of studies conducted to date on a side topic, differentiating MTF (maximum thumb force) and perceived exertion force [23], studies analyzing proprioceptive actions of the long thumb flexor (FPL) considered in the context of improving overall human performance [24]. or studies

among athletes involving ulnar and radial collateral ligament injuries, carpometacarpal and metacarpophalangeal joint dislocations, and phalangeal fractures [25], which do not directly explore the topic of overload injuries resulting from axial hypercompression, but may be useful in broader analyses.

Structural therapies have gained many advocates in recent years. As the phenomenon of this type of thumb overload may occur much more frequently in the future, it is important to study the issue and to look for opportunities to counteract the possible sequelae resulting from this type of pathology.

In contrast, clinical studies make many references to rehabilitation treatment with specialized tools. One of the more frequently evaluated in the literature is IAST therapy [26, 27].

However, while the studies presented here extensively analyze the impact of tool therapy on the effectiveness of treating specific conditions, they almost completely ignore ergonomic and comfort issues for the physiotherapist, not to mention the long-term effects of supporting specific regions of the hand during tool work. It is impossible to assess the clinical implications of overlooking this aspect of work, but it is undeniable that physiotherapy as hand work also requires a focus precisely on the hands as a therapeutic instrument.

CONCLUSIONS

The thumb subjected to axial loading during fascial therapy, and other therapies involving interference with soft structures, is exposed to overloads that break down anatomical elements of its structure. The consequences of chronic loading can be ligamentous pathologies of a flaccid nature, joint hypermobility and, in the long run, a potential risk of osteoarthritis involving the CMC, MCP and PIP joints.

A separate element is its endurance during operation, which, according to the results, decreases with each successive technique performed. In all likelihood, this can be counteracted by relieving the strain by using additional therapy tools, such as the M-Stick prototype. However, the aspect of partial loss of control over the patient's soft tissue behavior during therapy seems to be problematic. In addition, an important element is the design of the tool itself, as well as the comfort and ergonomics of operation, which, despite meticulous analysis and consideration during the design of the prototype, did not yield an ideal solution. Despite the fact that, by design, they should have completely relieved the therapist's hand, the results showed that this method, too, with prolonged work can be tiring, giving a decrease in work efficiency, and, in the perception of therapists, does not provide hand relief as expected. A potential solution theoretically could be the association of the two techniques giving potential thumb relief and simultaneous evaluation of tool work.

The M-Stick used raises enthusiasm. The key issue, however, is to expand the analysis of the fit to the hand and its further modification increasing the stability of the work. Since the value of its use has been recognized, it would also make sense to compare the evaluation of the effectiveness of the M-Stick and its effect on the hand with other existing soft tissue therapy tools on the medical market.

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The study received ethical approval from Academy Bioethics Committee (no. 18/2022) and written consent from participants to participate in the scientific study. The study obtained written consent from the subject for the X-ray examination.

CONFLICT OF INTEREST
The Authors declare no conflict of interest

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ORIGINAL ARTICLE

The study of sexual dimorphism based on the values of the finger index "2D:4D" in pair-group acrobatics

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ABSTRACT

Aim: Research and determination of the degree of manifestation of the inversion of sexual dimorphism using the study of the "2D:4D" index finger in acrobats of various roles and genders and non-athletes.

Materials and Methods: Pair-group acrobatics athletes, as well as peers who do not play sports, were studied. Acrobatic girls: roles at the top (n=32), age 13.96±1.02; roles in the middle and at the bottom (n=42), age19.36±2.86. Young acrobats: roles above (n=32), age 14.88±2.32; roles in the middle and below (n=48), age 20.38±2.89 (beginners, sub-elite and elite athletes). Statistical processing was performed using the STATISTICA 10.0 computer program: arithmetic mean (X), standard deviation (SD), standard error of the arithmetic mean (m), Brave-Pearson correlation analysis (r), the non-parametric U-Mann-Whitney statistical test, the Wilcoxon T test.

Results: In female athletes, in the middle and below, the female and equal type of hand bone was found in 76.20% of athletes, the male type of hand bone – in 23.80% of the subjects. In the male acrobats of those in the middle and below the male hand bone type was found in 100% of the athletes and the female hand bone type was found in none of those studied.

Conclusions: In male acrobats, not a single case of female hand bone type was found according to the "2D:4D" index finger, all subjects with male hand bone type. The feminine and equal type is found in a small percentage of young men who do not play sports.

KEY WORDS: sexual dimorphism, acrobats, role, index finger

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INTRODUCTION

For many years, the study of issues of sexual dimorphism of athletes, including the masculinization of female athletes, continues to be studied and is relevant (Bugaevsky, 2016) [1-3]. As you know, sexual differences, or sexual dimorphism, mean two signs: either biologically determined differences between women and men, or their psychological characteristics and social behavior [4-9].

The development and implementation of the methodology for the study of indicators of the index finger in the aspect of sexual dimorphism belong to Manning, which is covered in a significant number of scientific works [10-14] (Manning, 2002, 2011; Manning, Taylor, 2001; Manning, Barley, 2000; Manning, Stewart at all, 2004) and etc.

The topic of the study of the 2D:4D index finger was continued by the following scientists: Dressler, Voracek (2010), Voracek and Loibl (2009) [16], Voracek, Pietschnig at all (2008) [17], Hichkey, Doherty, Hart et al (2010) [18]; Koehler, Simmons at all. (2004) [19], Lilley, Laaksonen at all (2010) [20], Bescos, Esteve et al. (2009) [21], Voracek, Manning & Dressler (2007) [22], Voracek, Pietschnig at all (2008) [23], Vilyanskyi, Batechko (2020) [24].

But there are practically no scientific works on the study of the peculiarities of the study of sexual dimorphism in acrobatics based on the data of finger proportions. This was found out by analyzing literature on the Internet and bibliographic databases (Google Scholar, PubMed, Index Copernicus). The obtained data showed that the study of the features of sexual dimorphism with the help of the index method, specifically in pair-group acrobatics, taking into account different roles, is still poorly studied and requires deeper and thorough research.

Thus, our analysis of literary sources on the research of various scientists on the topic of sexual dimorphism confirms the relevance of the chosen direction in pair-group types of sports acrobatics.

AIM

Research and determination of the degree of manifestation of inversion of sexual dimorphism using the "2D:4D" index finger (proportion index) in acrobats of different genders and roles and non-athletes,who don't play sport.

MATERIALS AND METHODS

RESEARCH MATERIALS AND METHODS PARTICIPANTS

Athletes specializing in pair and group sports acrobatics, representatives of sports schools and clubs of the Dnipropetrovsk and Zaporizhzhia regions (Ukraine), as well as persons of the same age and in the same number who do not play sports (students of higher education institutions) took part in the research.). Acrobatic girls,l and boys were divided into 2 groups taking into account the functional duties (roles) in the group and pair (X±SD): 1) roles above (n=32), puberty age (13, 96±1.02), 2) middle and lower roles (n=42), youth age (19.36±2.86).

Young acrobats (X±SD): 1) roles above (n=32), average age 14.88±2.32; 2) roles in the middle and below (n=48), average age 20.38±2.89. Sports qualification of athletes: beginners, sub-elite and elite athletes.

Ethical statements and participants. Research involving human subjects was performed in accordance with all relevant national institutional policy and National Health Council guidelines, in accordance with the Declaration of Helsinki. All participants and parents of minors gave written informed consent for the study and were informed of the purpose and procedures of the testing, as well as the possibility of withdrawing consent at any time for any reason. Informed consent was obtained from all individuals included in this study.

METHODS

Procedure: The study of the index finger was carried out by measuring the second and fourth fingers on the right hand from the inner edge of the basal ridge at the base of the finger to the tip of the finger in each subject according to the method developed by J.T. Manning and co-authors (1998, 2008). Each finger was measured twice using a caliper (with an accuracy of 0.01 mm). A "2D:4D" digital index value less than 0.99 was considered to be a male type of hand, bone and a value between 0.99 and 1.1 was considered to be a female type.

STATISTICAL ANALYSIS

Statistical processing was carried out using the computer program STATISTICA 6.0 and MS Excel XP software packages with an open license for non-commercial use. The main indicators of mathematical statistics were: arithmetic mean (X), standard deviation (SD), standard error of the arithmetic mean (m), median, 25 and 75 centiles, Brave-Pearson correlation analysis (r). The Shapiro-Wilk test was used to check the conformity of the sample with the law of normal distribution. Due to the fact that the samples did not correspond to the law of normal distribution, the non-parametric U-Mann-Whitney statistical test was used for two independent samples (when comparing acrobats of groups of athletes and those who do not play sports of both sexes, acrobat girls and boys acrobats).

The Wilcoxon T test was used to test dependent samples. The level of reliability was set – P=95%, the level of significance – p=0.05. For some experimental data, higher levels of reliability P=99%, P=9.99%, significance level p=0.01 and p=0.001 were obtained, respectively.

RESULTS

We used the "2D:4D" index finger as a morphological feature reflecting gender differences, i.e. the ratio of the length of the second (index) finger to the length of the fourth (ring) finger.

As a result of our research, it was established that acrobats have morphological signs of inversion of sexual dimorphism according to 2D:4D finger proportions. The finger index is calculated for the right and left hands, and its average value is determined.

The results of the evaluation of sexual dimorphism according to the data of the index finger "2D:4D" are shown in the table. 1. Measurements were made according to the method developed by J. Menning (Menning, 1998, 2008) [25, 26], namely the ratio of the length of the second and fourth fingers of the hand on the right hand, from the inner edge of the basal ridge at the base of the finger to the tip of the finger.

There is scientific evidence that the index finger on the right hand is the marker that is more informative than on the left hand [27]. Therefore, in our studies, we performed measurements on the right hand of those we studied.

Each finger was measured twice using an electronic caliper (with an accuracy of 0.01 mm). According to the above method, the value was distributed as follows: "2D:4D" index finger less than 0.99 – male type of hand, value from 0.99 to 1.1 – female type.

Among the acrobats aged 16-23, the roles in the middle and below, statistically significant gender differences were found between the female type of the acrobats' index fingers. Also, among girls who do not play sports, with indicators of female and equal hand bone types, the indicators differ statistically significantly between the group of girls who do not do sports, with male hand bone types (Table 1).

Non-sporting girls with indicators of a female and mixed type of hand bone are significantly different by gender from a group of young acrobats with a male type of hand bone , as well as from a group of young men with a male type of hand bone who do not do sports.

According to the indicators of the non-parametric U-Mann-Whitney statistical test, at a significance level of $p<0.05$, the following was found between acrobats of the above roles and non-sports persons of pubescent age.

Both female/mixed and male hand bone types are found in both acrobats and non-athletes. But in female athletes, the male type was found in a larger number of test subjects. In boys acrobats of both sexes of puberty age, roles above, not a single case of female hand type was found, and in 100% of subjects (n=32) – male type. In people who do not play sports, not a single case of manifestation of the female hand bone type was found. Among the acrobats in the roles above, 10 people have the same type of the index finger indicators, and 22 have the male hand type (Table 2).

Correlation analysis (Table 3) between various indicators of sexual dimorphism of acrobats of different roles showed a significant number of statistically reliable correlations (from r=0.402 to r=636, $p<0.05$), which confirms the relationship and kinship of some indicators of sexual dimorphism with adjacent ones.

Table 1. The Index finger indicators "2D:4D" in acrobats of both genders, middle and bottom roles, and non-athletes

Statistical indicators	Girls 16-23 years old				Young men 16-23 years old			
	Acrobats (n=42)		Those who do not do sports (n=42)		Acrobats (n=42)		Those who do not do sports (n=42)	
	Female and mixed type (n=32)	Male type (n=10)	Female and mixed type (n=39)	Male type (n=3)	Female and mixed type	Male type (n=48)	Female and mixed type (n=0)	Male type (n=48)
	1	2	3	4	5	6	7	8
%	76,20 %	23,80 %	92,85 %	7,15 %	–	100 %	–	100 %
x±m	0,993± 0,001	0,887± 0,003	1,003± 0,004	0,887± 0,001	–	0,887± 0,002	–	0,887± 0,003
SD	0,0006	0,0005	0,0007	0,0004	–	0,0005	–	0,0006
Min	0,991	0,884	0,993	0,886	–	0,884	–	0,884
Max	0,997	0,899	1,009	0,889	–	0,899	–	0,899
$P_{1-3}<0,05$; $p_{3-4}<0,05$; $P_{3,6}<0,05$; $P_{3,8}<0,05$								

Table 2. Indicators of the index finger "2D:4D" in acrobats of both sexes, the roles above (12-15 years) and non-athletes

Statis-tical indi-cators	Girls 12-15 years old				Boys 12-15 years old			
	Acrobats (n=32)		Those who do not do sports (n=32)		Acrobats (n=32)		Those who do not do sports (n=32)	
	Female and mixed type (n=24)	Male type (n=8)	Female and mixed type (n=28)	Male type (n=4)	Female and mixed type (0)	Male type (n=32)	Female and mixed type (10)	Male type (n=22)
	1	2	3	4	5	6	7	8
x± SD	1,001± 0,005	0,944± 0,054	1,014± 0,170	0,915± 0,416	–	0,887± 0,002	1,004± 0,003	0,888± 0,004
m	0,001	0,02	0,02	0,02	–	0,00004	0,0009	0,0009
min	0,991	0,887	0,993	0,887	–	0,884	0,999	0,884
max	1,009	1,002	1,1	0,996	–	0,899	1,009	0,899
$P_{1,6}<0,05$; $P_{1,8}<0,05$; $P_{6,7}<0,05$; $P_{7,8}<0,05$								

Table 3. Correlation coefficients of the nature of the relationship between the index finger and the psychological gender characteristic

The index finger „2D:4D"	Masculine psychological gender		Androgynous psychological sex	
	Roles are those above		Roles are those in the middle and below	
	Acrobat girls (12-15 years old)	Young acrobats (12-15 years old)	Acrobat girls (16-23 years old)	Young acrobats (16-23 years old)
Female hand bone type	0.402	–	0.334	–
Male type	0.515	0.502	0.636	0.512

Note: the level of significance is p<0.05

The indicator "female hand bone type" is reliably correlated with male psychological gender (r=0.402; p<0.05)

DISCUSSION

At the current stage, sports require large loads with a high degree of intensity from those who are engaged in various stages of the multi-year process. It is assumed that the greatest sporting successes are achieved by women with signs of gender inversion. As you know, there are morphological and other criteria that allow identifying female athletes of the masculine type.

At the current stage of sports development, the selection of athletes involves a number of principles, which include the use of such an important diagnostic method as the "2D:4D"

the index finger according to J.T. Menning. Scientists found that the growth of the index finger affects the hormone estrogen (the so-called "female" hormone), and the ring finger affects the hormone testosterone ("male"). A "2D:4D" ratio of 0.99-1.1 is female. Those values below this level indicate an increase in testosterone levels.

Scientists consider intrauterine development of a female fetus in conditions of increased androgen content as one of the factors that can affect the finger proportion. This is typical for women who work out before and during pregnancy.

The use of the finger index provides an additional opportunity during the sports selection and training process to identify female athletes with congenital manifestations of masculinization [27].

Within the framework of our work, the study of the processes of adaptive changes of sexual somatotypes according to the values of the index finger in athletes of puberty (13-15 years) and youth (16-23 years) was considered.

Within the framework of our work, the study of the processes of adaptive changes of sexual somatotypes according to the values of the index finger in athletes of puberty (13-15 years) and youth (16-23 years) was considered.

As you know, finger indexes are innate indicators. We associate a significant percentage of female athletes with male hand bone type indicators with the fact that when selecting female athletes for roles in the middle and below, attention is paid to acrobats with manifestations of masculinity.

In girls who do not do sports, the dominance of female and equal hand bone types was revealed in comparison with acrobats. As a significant number of specialists emphasize, in their research they observed a predominance of female athletes with various signs of acquired and congenital masculinization.

The specificity of sports selection, taking into account its multi-stage process, contributes to the concentration of female athletes with special individual characteristics that approach male indicators and parameters. According to the results of the research, among the acrobats, the middle and lower positions are dominated by female athletes with genetically determined masculinization. This index can be used in combination with other criteria of masculinization of the female body.

The results of the application of the non-parametric U-Mann-Whitney statistical test at a significance level of $p<0.05$ showed the following.

Significant gender differences in the size of the finger indices were obtained ($p<0.05$). Acrobats with female and mixed hand bone type are statistically different from the group of acrobats with male hand bone type, as well as boys from the group of non-athletes with male hand bone type indicators.

Between acrobats with a male type and boys from a group of non-athletes with a female and equal hand type, reliable differences were also found. In the group of young men who do not play sports, statistically significant differences were found between those with a female and equal hand type and those with a male type (Table 2).

The index finger is the level of prenatal androgenization. It is necessary to take into account the factor of the difference in sample size. Also, differences within the same population, taking into account age and role, as well as the specificity of selection on anthropometric and morphometric indicators, may be important.

CONCLUSIONS

Finger proportions 2D:4D, together with other indicators, can serve as markers reflecting the masculinization of sportsmen, and are criteria for selection for specialization in pair-group types of acrobatics.

Masculine features in female athletes give a number of advantages in sports, especially in those types where strength and endurance are necessary. Pair-group types of acrobatics, in our opinion, can be attributed to this group of sports. Therefore, the index finger can be used in combination with other criteria when selecting athletes for specific sports or roles in narrow specializations.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Assessment of the impact of working under COVID-19 conditions on the psychophysical state of nurses

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ABSTRACT

Aim: The COVID-19 pandemic caused many unfavorable changes in nurses' daily work, which affected their health and well-being. The objective of the study was to assess the impact of working under COVID-19 conditions on the psychophysical condition of nurses.

Materials and Methods: The study included a group of 100 nurses from the Łódź Voivodeship working under COVID-19 conditions. A survey questionnaire consisting of questions on health status, the occurrence and severity of symptoms resulting from work in covid conditions was used.

Results: Statistically significant ($p<0.001$) increases in physical ailments were found in nurses after a change in working conditions. The largest effect was observed for dyspnoea, headache and lumbar pain. The severity of physical ailments was mainly affected by the age of the respondents and the presence of chronic diseases. There was also a statistically significant ($p<0.001$) deterioration in the mental state of the respondents, primarily in terms of feelings of mental fatigue, mood decrease and feelings of fear for the health of relatives. An increase in fear for one's own health was also observed, particularly in nurses with older age, higher BMI, longer work experience and chronic diseases.

Conclusions: The change of working conditions during the COVID-19 pandemic adversely affected the psychophysical health of nurses. The respondents showed an increase of the symptoms of chronic diseases, headaches and back pain. Working in difficult conditions and chronic stress resulted in a depressed mood and fear for one's own life and that of relatives. Thermal treatment may be recommended to improve the psychophysical condition of nurses.

KEY WORDS: nurses, pandemic, psychophysical status, COVID-19 conditions

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INTRODUCTION

The COVID-19 pandemic has brought many adverse changes in the daily work of medical staff. New, specific conditions related to direct contact with patients infected with the SARS-CoV-2 virus have increased the burden on healthcare professionals. For safety reasons, they had to use personal protective equipment that was strictly defined in the WHO (World Health Organization) guidelines and GIS (Chief Sanitary Inspectorate). Special outfit consisting of: FFP2 or FFP3 filter mask, suit or waterproof surgical apron, surgical cap, goggles, visor, long and short medical gloves, protective shoes, shoe protectors, caused discomfort and difficulties at work. The long stay in it negatively affected medical staff' organisms. In addition, caring for patients with confirmed SARS-CoV-2 infection was a stressful situation and aroused fear of their health and that of their family members [1-4].

The group of health care workers who, due to their responsibilities, was particularly vulnerable to the negative effects of a pandemic are nurses. As part of their professional duties, they have particularly close contact with the patient. The scope of their health activities is specified in the Act on the Occupation of Nurse and Midwife [5].

Performing care and diagnostic procedures, injections, putting on cannulas, catheters, anti-medicine prophylaxis, washing and feeding patients, transport for tests are certainly not all procedures that are the responsibility of nurses [6].

It should be noted that the situation of the professional group of nurses has been systematically deteriorating in recent years. There is a decrease in interest in taking up work in this difficult and demanding profession.

The specificity of work in hospitals and the shift system cause both mental and physical loads that result in the occurrence of various ailments and fatigue [7, 8]. Night work for nurses should be treated as a factor conducive to the occurrence of many diseases. The European project research report Nurses' Early Exit Study (NEXT) shows that 70% of shift workers are unable to survive to statutory retirement due to various ailments resulting from such work [5].

A large number of patients, staff shortages and simultaneous work in several places cause accumulation of negative psychophysical loads [7, 8].

The COVID-19 pandemic forced the creation of single-name hospitals and changes in the functioning of other health care facilities. Work in health resorts, spa sanatoriums

and health resort hospitals was also reorganized. New procedures have been created to ensure the safety of patients and employees. Reducing the number of patients, limiting contact with other people, i.e. maintaining distance, frequent hand disinfection and wearing a face mask are some of them. An absolute condition for stay was a negative Covid test result [2, 9].

A special place of work during the pandemic were Covid wards, where nurses were forced to work in extremely stressful conditions [2, 3].

AIM

The aim of the research was to assess the impact of working under COVID-19 conditions on the psychophysical state of nurses and to identify factors that could have affected its deterioration.

MATERIALS AND METHODS

The research was carried out on a group of 100 nurses from the Lodz Voivodeship. The age of the respondents ranged from 23 to 65 years; half of them were no more than 47 years old (IQR: 37-52 years). The shortest seniority in the profession was 1 year and the longest – 39 years; for half of respondents, it did not exceed 21.5 years (IQR: 11-28.5 years). The body mass index (BMI) ranged from 18.4 to 38.1 kg/m^2; in half of the respondents did not exceed 25.2 (IQR: 22.9-28.1) kg/m^2. 48% of respondents had a normal weight (BMI values from 18.5 to 24.9 kg/m^2), 39% were overweight (BMI values from 25.0 to 29.9 kg/m^2) and 13% were obese (BMI of 30.0 kg/m^2 or greater).

Before starting the research, nurses were qualified for the experiment. The inclusion criterion was the working time in the covid ward not less than two months. The research tool was a survey questionnaire comprised of questions about the state of health, occurrence and severity of symptoms resulting from work in covid conditions. The intensity of the ailments was assessed on a scale of 0 to 10, where 0 meant no problem and 10 - a very strong problem.

A positive opinion of the Bioethics Committee No. RNN/165/21/EC of 8 June 2021 was obtained for conducting the research. All nurses were informed of the purpose of the study and gave their informed consent. Each respondent completed the survey twice: in the week in which she started working in the covid ward and again after the liquidation of the ward and returning to previous working conditions.

Statistical analysis was carried out using the statistical package STATISTICA PL v. 13.3 and the JASP package v. 0.16.3.

Quantitative variables were characterized by providing, due to the lack of normal distribution, order statistics: median (Me) and interquartile range (IQR), presented as the interval between the first and third quartiles (Q25-Q75). The same measures were given for variables measured on a ordinal scale. For qualitative variables, the number of observations for each category and the corresponding percentage were presented.

The normality of quantitative variables was tested using the Shapiro-Wilk normality test. Wilcoxon signed-rank test was used to compare the severity of psychophysical ailments before a pandemic and after changing the working conditions to work in the covid ward. The effect size measure was calculated as $r = z\ \sqrt{N}$, with z being the value of Z statistics determined from the results of the Wilcoxon test, N – sample size. The effect is considered small when $r \in (0.10\text{-}0.30)$, intermediate when $r \in [0.30\text{-}0.50)$ and large when $r \geq 0.50$ [10].

In addition, the point-biserial correlation coefficient (to assess the relationship between quantitative and nominal variables), the rank-biserial correlation coefficient (to assess the relationship between order and nominal variables) with corresponding significance tests and the Cramer's V coefficient (together with the chi-square independence test) were used to assess correlation.

The results were considered statistically significant at $p < 0.05$.

RESULTS

Most of the examined nurses (95%) worked in shifts, 44% were employed in 2 or 3 workplaces.

49% of nurses suffered from at least one chronic disease, including: hypertension was reported in 22%, asthma in 13%, varicose veins in 12%, diabetes in 5% of respondents.

The shortest period of time worked in the covid ward was 2 months, and the longest 13 months; for half of the respondents, the employment period in the Covid branch did not exceed 7 months (IQR: 5-8 months).

The change in working conditions in the COVID-19 pandemic had a negative impact on the health of respondents, both in the physical and mental areas.

The severity of chronic disease symptoms as a result of changes in working conditions was reported by the majority (N = 45; 91.8%) among nurses involved in the study who were affected by such diseases. In particular, worsening of asthma symptoms was reported by 12 out of 13 asthma respondents (92.3%), worsening of hypertension symptoms – by 19 respondents out of 22 with hypertension (86.4%), worsening of diabetes symptoms – by 4 respondents out of 5 with diabetes (80%); worsening of ailments related to lower limb varicose veins was reported by all 12 respondents burdened with this disease.

The change in working conditions associated with the COVID-19 pandemic caused the severity of selected physical ailments in most nurses. In particular, 71% of respondents reported worsening of lower limb edema, worsening of low back pain – 77%, worsening of headaches – 81%, more frequent appearance of scotoma – 24% and a stronger feeling of dyspnea – 89%.

Table 1 shows the results of the comparison of the severity of selected physical ailments before the pandemic and after the change in working conditions and working in the covid ward. In each case, a statistically significant increase in the discussed physical ailments was observed. The largest effect (effect size measure > 0.5) was observed for dyspnea, headache and low back pain.

Work in the Covid ward also resulted in deterioration of the mental state of the surveyed nurses. In particular, 98%

Table 1. Assessment of severity of selected physical ailments before the pandemic and after the change in working conditions

Ailments	Median (IQR)		Z statistics	p-value	Effect size measure
	before working in the covid ward	after working in the covid ward			
Lymphedema	1 (0-3)	3 (0-5)	7.02	0.000	0.497
Low back pain	3 (1.5-3)	5 (3-6.5)	7.44	0.000	0.526
Headache	0 (0-2)	3 (2-5)	7.82	0.000	0.553
Scotoma	0 (0-0)	0 (0-1)	4.29	0.000	0.303
Dyspnea	0 (0-1)	3 (2-5)	8.19	0.000	0.579

Table 2. Assessment of the mental state before the pandemic and after the change in working conditions

Ailments	Median (IQR)		Z statistics	p-value	Effect size measure
	before working in the covid ward	after working in the covid ward			
Mood decrease	0 (0-2)	5 (3-6)	8.59	0.000	0.608
Anxiety about own health	0 (0-1)	4 (2-6)	8.33	0.000	0.589
Anxiety about health of family members	0 (0-1)	5 (4-8)	8.51	0.000	0.602
Mental fatigue	1 (0-3)	7 (5-9)	8.68	0.000	0.614

Table 3. Assessment of the relationships between the severity of physical ailments after a change in working conditions and selected characteristics of respondents

Variables	Severity of symptoms				
	Lymphedema	Low back pain	Headache	Scotoma	Dyspnea
Age	r_{pb}=0.422 p=0.000	r_{pb}=0.250 p=0.012	ns	ns	ns
Body Mass Index	r_{pb}=0.228 p=0.022	ns	ns	ns	ns
Work experience (years)	r_{pb}=0.373 p=0.000	ns	r_{pb}=0.221 p=0.027	ns	ns
Duration of work in the covid ward (months)	ns	ns	ns	ns	ns
Number of workplaces	ns	ns	ns	ns	r_{rb}=0.397 p=0.015
Chronic diseases	V=0.406 p=0.000	V=0.203 p=0.042	ns	V=0.292 p=0.003	ns
Shift work	ns	ns	V=0.357 p=0.003	ns	ns

r_{pb} – point-biserial correlation coefficient; r_{rb} – rank-biserial correlation coefficient; V – Cramer's V; p – p–value; ns – not statistically significant correlation

of respondents reported a decrease in mood, an increase in anxiety about their own health – 92%, an increase in anxiety about the health of family members – 96%, and mental fatigue – 100% of respondents.

Table 2 presents the results of the comparison of the assessment of mental state before the pandemic and after the change of working conditions. In each case, a statistically significant deterioration in the mental state of the respondents was observed. All effects should be considered large.

Table 3 presents statistically significant (p<0.05) correlations between selected characteristics of the examined nurses and the severity of physical ailments (no/yes) after changing the working conditions for work in the covid ward.

A statistically significant increase in the occurrence of lower limb edema was observed in nurses with an average older age (48 (44-53) vs 37 (28-46) years), with an average higher body mass index (25.5 (23.5-28.3) vs 23.3 (21.6-25.9) kg/m^2; in particular, it was noticeable in obese nurses - 84.6% vs 64.6% in nurses with a normal weight) and an

average longer work experience in the profession (23 (18.5-29.5) vs 12 (4-24) years), as well as the presence of chronic diseases (89.8% vs 51.9%).

The worsening of low back pain was observed in nurses with an average older age (48 (41-53) vs 42 (30-48) years) and with chronic diseases (85.7% vs 68.6%).

Increased headache complaints were experienced by respondents with, on average, longer work experience (23 (15-29) vs 10 (5.5-24.5) years) and those, who worked in the shift system (84.2% vs 20.0%).

The severity of scotoma was reported for respondents with chronic diseases (36.7% vs 11.8%).

Dyspnea increased more frequently for nurses working in more than one workplace (97.7% vs 82.1%).

The length of employment in the covid ward did not significantly affect the severity of the analysed physical ailments.

Table 4 presents statistically significant ($p<0.05$) correlations between selected characteristics of the surveyed nurses and deterioration of mental state (no/yes) after changing the working conditions for work in the Covid ward.

Mood decrease occurred in nurses with an average shorter employment period in the covid ward (7 (5-8) vs 10.5 (9.3-11.8) months).

Anxiety about own health increased in a statistically significant way among respondents with an average older age (48 (40-52) vs 29 (27.8-37) years), with an average higher body mass index (25.4 (23.1-28.1) vs 22.4 (21.3-23.4) kg/m^2; in particular, fear for their own health was reported by all obese nurses and as many as 85.4% of those with a normal weight), with an average longer work experience (23 (15-29.3) vs 4.5 (3-13.5) years), and with chronic diseases (100.0% vs 84.3%).

There was no relationship between the severity of anxiety about the health of family members as well as the feeling of mental fatigue and the examined characteristics of nurses. The number of workplaces and shift work did not statistically significantly affect the deterioration of the mental state of the nurses surveyed.

DISCUSSION

The COVID-19 pandemic has caused many adverse changes in the lives of various social and professional groups. This was particularly evident in the functioning of nurses who were on the front line of the "fight" against the SARS-CoV-2 virus. Dangerous working conditions, a large number of infected patients and overcrowded hospitals significantly worsened their professional situation [2, 11].

A pandemic has shown that nursing is a work of a special nature due to the possibility of infection, overloading the body and emotional burden. To ensure safety, medical staff of the covid wards had to use a special outfit that did not let in air. It constituted a barrier to the virus, but at the same time caused very much discomfort and difficulties at work. Staying in it for a long time gave an additional load to the body [1, 4]. Increased physical effort, e.g. during frequent resuscitation, was particularly severe. Such aggravating working conditions adversely affected the health of nurses. The study group found worsening symptoms of chronic diseases such as asthma, diabetes and varicose veins. Similar results were found on the basis of a systematic review, which included 14 studies involving 11 746 medical workers and meta-analysis, carried out by Galanis et al. [4].

The forced position of the body during the work of nurses means that they are exposed to musculoskeletal disorders. Constant overloads are conducive to the acceleration of degenerative processes and the occurrence of occupational diseases [7, 12]. Kułagowska et al. [13] in a study conducted in stationary healthcare facilities among 1299 nurses showed

Table 4. Assessment of the relationships between deterioration of mental state after a change in working conditions and selected characteristics of respondents

Variables	Deterioration of mental state			
	Mood decrease	Anxiety about own health	Anxiety about health of family members	Mental fatigue
Age	ns	r_{pb}=0.326 p=0.001	ns	ns
Body Mass Index	ns	r_{pb}=0.203 p=0.043	ns	ns
Work experience (years)	ns	r_{pb}=0.305 p=0.002	ns	ns
Duration of work in the covid ward (months)	r_{pb}=-0.242 p=0.015	ns	ns	ns
Number of workplaces	ns	ns	ns	ns
Chronic diseases	ns	V=0.289 p=0.012	ns	ns
Shift work	ns	ns	ns	ns

r_{pb} – point-biserial correlation coefficient; V – Cramer's V; p – p–value; ns – not statistically significant correlation

that more than half of the respondents complain of pain in the musculoskeletal system, and every tenth is chronically ill.

The change in working conditions associated with the COVID-19 pandemic caused most nurses to increase physical discomfort, such as swelling of the lower limbs and pain in the lumbar spine. Musculoskeletal system overloads were associated with the need for long-term standing work, support for patients in an inclined or torsional position, lifting or transporting [8]. Negative effect on the musculoskeletal system in medical staff, caused by work with patients infected with the SARS-CoV-2 virus, was noticed by Aydin and Atic [14]. In this study, nurses constituted the largest part of the study group, and the pain was most often located in the lumbar and cervical spine.

The survey also found more frequent headaches, scotoma and feeling of dyspnea. This can be explained by hypoxia associated with the need to stay in masks for a long time and overheat the body in a special outfit [4]. These adverse factors accumulated especially in situations where nurses worked in more than one covid ward, and this intensified the shift nature of the work. The negative impact of the shift system, which disrupts the circadian rhythm, is also described by other authors [15, 16].

The mental burden associated with nursing work is described by many authors [8, 11, 14]. A large number of hours, insufficient length of rest between shifts and a twelve-hour work system promote chronic fatigue. Factors such as the number and complexity of incoming information, volatility, the need to make difficult decisions, intensify this state even more [8]. In addition, during a pandemic, the risk of direct contact with the SARS-CoV-2 virus and the fear of infection generated high levels of stress [3, 18]. The need to deal with the emotions that daily care of patients in critical condition aroused, caused depression. Participation in difficult life situations of patients and a large number of deaths affected the feeling of helplessness, sleep disturbance and significant mental fatigue in nurses. In the study, everyone had a lower mood, which was more severe in respondents with shorter seniority in the covid ward. In turn, fear for one's own health was particularly severe in middle-aged people and chronic diseases, which may be associated with fear of a more severe disease.

Research conducted by Sierakowska et al. [17] also confirm the occurrence of high levels of stress related to the COVID-19 pandemic and emphasize the need to implement a strategy for the protection of the mental health of nurses. The authors state, however, that special attention should be paid to younger nurses who have shorter seniority. Also Vanhaecht et al. [19] examining healthcare workers in Belgium (among whom 33.4% were nurses) found the negative impact of the SARS-CoV-2 pandemic on mental health. Disturbing symptoms such as stress, fatigue, sleep and concentration problems, fear and depression caused the need for psychological support. Similarly, Piotrowski et al. [11] observed the prevalence of stress due to pandemic-related overwork among nurses in Poland and Iran. The authors noticed a different severity of this problem, which may be due to cultural differences.

Lavoie-Tremblay et al. [20] found a state of chronic fatigue and reduced job satisfaction based on the study of nurses caring for patients with COVID-19 in Canada. It was noted that less well-prepared employees even intended to change jobs and occupation.

Systematic review of 93 studies (n = 93 112) and meta-analysis carried out by Al Maqbali et al. [21] showed, that about a third of nurses working during the COVID-19 epidemic suffered from mental symptoms.

In all the articles cited, the authors unanimously emphasize the need to provide comprehensive support strategies to reduce the psychological burden.

Balneological treatment seems to be particularly useful in achieving balance after such difficult experiences related to work during the COVID pandemic. Physical treatments reduce pain, inflammation and relax tense muscles. Electrotherapy, magnetotherapy and laser therapy are an effective form of treatment for spinal pain syndromes resulting from overload. An individually selected exercise program normalizes muscle tension and improves physical condition. Breathing exercises increase lung ventilation and reduce feeling of dyspnea. Lymphatic massage can be used to treat lower limb edema. Whole-body cryotherapy is recommended to accelerate the body's regeneration and reduce stress. Exposure of the body to low temperature causes an increase in endorphin levels, which improves mood. Thermal treatments, peloidotherapy, hydrotherapy and massages help restore psychophysical balance. The change of climate and environment provides a relaxing effect [18, 22, 23].

As the COVID-19 pandemic has shown, the profession of nurse is particularly associated with numerous health threats. Exposure to biological agents at the workplace promotes increased psychophysical burden. The presented own and other authors' research draws attention to the need to organize activities preventing the occurrence of adverse consequences of work performed and to protect this occupational group, regardless of specific situations such as the COVID-19 pandemic.

CONCLUSIONS

1. The change in working conditions during the COVID-19 pandemic adversely affected the psychophysical health of nurses.
2. Unfavourable working conditions caused an increase in symptoms of chronic diseases and ailments of headache and back pain.
3. Work in difficult conditions and chronic stress resulted in a lower mood and the occurrence of fear for the lives of themselves and family members.
4. Thermal treatment may be recommended to improve the psychophysical condition of nurses.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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ORIGINAL ARTICLE

Fostering the social activity of future specialists in physical education and sports in a health-preserving environment

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ABSTRACT

Aim: The aim of the study is to conduct an analysis of the current state of social activity fostering of future specialists in physical education and sports in a health-preserving environment with the possibility of using social networks by teachers during mixed and distance forms of education.

Materials and Methods: The research was conducted during 2022–2023 of the Luhansk Taras Shevchenko National University, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Poltava State Medical University. There were 320 respondents involved in the experimental work majors 014 «Secondary Education (Physical Culture)», 017 «Physical Culture and Sports» and 227 «Therapy and Rehabilitation». Research methods: theoretical, empirical, methods of statistical data processing.

Results: Education of students' social activity is carried out not only during studies, but also in extracurricular, leisure activities. Educational hours, beauty and health festivals, flash mobs and social projects have been introduced by group advisors in higher education institutions: «My value orientations», «Olympic week», «I am for a healthy lifestyle», «Believe in yourself» festival, «Beauty and health», «Respect by action» training, holding student and student leagues «JuniorS Games» and others.

Conclusions: With the help of Google Forms, we determined the motives and interests in various types of physical activity and sports, the attitude of student youth to the organization of the educational process on various online platforms using various social networks.

KEY WORDS: fostering of social activity, future specialists in physical education and sports, social networks, health-preserving environment, distance and mixed forms of education, quality of the educational process

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INTRODUCTION

The organization of the educational process in institutions of higher education is carried out on the basis of competency-based and student-centered approaches [1]. In recent years, it is necessary to pay considerable attention to «self-realization, development, participation and integration in public life, opportunities to realize one's potential in Ukraine» [2]. The priority task of physical education and sports among student youth for the period until 2025 is to provide participants in the educational and educational process of higher education institutions (HEI) with health-improving physical activity, physical culture and sports for comprehensive harmonious development and health formation, as the highest social value in the state, identifying the reserve capabilities of the organism, forming humanistic values, patriotic feelings, and a positive image of the state in the world community; formation of a valuable attitude towards one's own physical health and sports, physical and spiritual improvement [3].

The forms of manifestation of social activity are: amateur-creative, cognitive-labor, educational-educational, communicative, social-organizational, social-cultural. Today, civic activism, which is «a form of self-realization and self-activity of an individual as a full-fledged member and subject of civil society» acquires great importance in the education of young people. The effectiveness of the activity of a teacher at a higher education institution is determined by his scientific and research work with students, the ability to involve students of higher education in creative cooperation using modern social networks, to form in them a desire for knowledge with the help of the latest methods and technologies and, in particular, to foster the social activity of future specialists in physical education and sports in a health-preserving environment. Under such conditions, students willingly participate in the discussion of scientific problems held by departments, in scientific competitions, webinars, trainings, scientific and practical conferences of various levels [4-7]. In particular, in the State Institution «Luhansk National University named after Taras Shevchenko», the Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council and the Poltava State Medical University during martial law, mixed and distance forms of education are used.

AIM

The aim of the study is to conduct an analysis of the current state of social activity fostering of future specialists in physical education and sports in a health-preserving environment with the possibility of using social networks by teachers during mixed and distance forms of education.

MATERIALS AND METHODS

The research was conducted during 2022-2023 at the educational and scientific Institute of Physical Education and Sports of the Luhansk Taras Shevchenko National University, Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, Poltava State Medical University. There were 320 respondents involved in the experimental work. In order to obtain information about the rational use of free time by students, we conducted a study among young men and women of the three above-mentioned institutions of higher education, majors 014 «Secondary Education (Physical Culture)», 017 «Physical Culture and Sports» and 227 «Therapy and Rehabilitation». A choice of several types of extracurricular activities was offered: various types of motor activity, fitness training; travel; internet leisure; hobbies; use of health-saving technologies, recreational activity, rest in nature.

With the help of Google Forms, we determined the motives and interests in types of physical activity and sports, the attitude of student youth to the organization of the educational process on various online platforms using various social networks. Teachers developed distance courses in professional disciplines. Methodical support of the educational process involves, along with traditional forms, the introduction of the latest learning technologies; extensive use of resources of the local network of departments, universities, use of the Internet, modern multimedia software, distance learning site Moodle «Educational portal of Luhansk Taras Shevchenko National University», social networks Viber, Facebook, YouTube, Instagram, Telegram, Skype for active communication and communication; changes in the format of monitoring the use of online tests and performance of creative tasks.

At each of the above-mentioned stages of the experimental program, a set of methods was used:

- *theoretical:* analysis, synthesis, comparison, juxtaposition; generalization (to clarify the key concepts of the study, to highlight the structural components of the studied readiness, to substantiate the methodological foundations of the study, to formulate conceptual provisions and conclusions);
- *empirical:* conversations, interviews, surveys, testing, the method of narratives, pedagogical observation of students; sociological research methods (online surveys using modern social networks and platforms); pedagogical experiment;
- *statistical:* for mathematical processing of pedagogical experiment data, quantitative and qualitative analysis of research results and proving their statistical reliability, graphic visualization.

RESULTS

In today's conditions, due to Russian aggression, a mixed form of education has been introduced in many educational institutions of Ukraine and attention to digital literacy, the value of health-preservation, fostering of personal and moral and spiritual values, the manifestation of an active position and the ability to adapt in society have been intensified. Therefore, the tasks of health-preservation for students of higher education are solved in the process of teaching the following disciplines: «Health-preserving technologies in physical education and sports», «Organization of tourism and health activities», «Pedagogical diagnosis of training in physical culture», «Organization of health and sports and mass work», «Theory and technologies of health-recreational motor activity», «Basics of health and rational nutrition», «Fitness technologies and recreation», «Sports medicine with the basics of physical culture and sports rehabilitation», «Paramedic medical care», «Mobility and recreational games», «Gymnastics with teaching methods», «Musical and rhythmic education and the basics of health fitness», «Technologies of physical culture and health activities for training people with special needs», «New technologies and modern methods of teaching physical culture in educational institutions», «Recreation in physical culture of different population groups», «Physical education», and others. Teachers in practical classes on gymnastics, fitness, health tourism and recreational games with students use systemic, differential and gender approaches to the distribution of the load, taking into account the physical fitness of the students; use modern means of motor activity that reflect social (healthy lifestyle), biological (motor activity, physical condition, physical fitness), psychological (motives, preferences, interests) and other characteristics of the use of means of physical culture and sports with a health-improving orientation to create healthy of a sustainable environment.

In the state institution Luhansk Taras Shevchenko National University, the Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council, the Poltava State Medical University following social networks are used: Facebook, Instagram, You Tube, Tik Tok etc. Moreover, teachers like networks such as Facebook and You Tube the most, while students of higher education are more active on Instagram and Tik Tok. Social networks are an important resource for the work of teachers and students in a higher education institution. One of the requirements for a teacher is the ability to use tools for remote work, including Zoom, Google meet, Microsoft Teams, Skype, Moodle, etc. Therefore, we recommend using the following educational resources: computer programs for correcting the physical condition, diagnosing the state of health and the level of physical fitness, presentations, master classes on various types of motor activity, webinars, video lectures and videos on the implementation of various forms practical and physical education classes.

It should be noted that teachers and students of higher education institutions take an active part in the organization and holding of conferences, including international ones,

which are always held on the ZOOM platform with the invitation of stakeholders, famous scientists, teachers and trainers. During the entire period of study, students are provided with targeted and systematic consulting assistance in the implementation of creative projects, writing theses, articles, and scientific works. In addition, creative groups and student societies are created, their scientific interests and abilities are taken into account, which are highlighted in social networks.

Next, we will consider the algorithm of actions for using social networks to attract students of pedagogical and medical institutions of higher education to study and exchange ideas and resources regarding health-preservation and sustainable development presented in Table 1.

Table 1. Algorithm of actions for the use of social networks to attract students of pedagogical and medical institutions of higher education to study and exchange ideas and resources regarding health-preservation and sustainable development

№	Algorithm of actions for using social networks	Description of tasks
1.	Analysis of the audience, needs and stakeholders	Thorough analysis of your target audience – higher education seekers and stakeholders. Understand their needs, interests, social habits, etc. Consider their views and interests.
2.	Choice of social networks	Determine on which social networks higher education students are active. Popular platforms include Facebook, Instagram, Twitter, LinkedIn, and others. Conducting a survey and identifying social networks for communication.
3.	Creating content	To develop pedagogically valuable content that will meet the needs of the student audience in a health-preserving environment, increasing stress resistance by means of new types of motor activity (fitness technologies, floorball, ringo, panna, skipping, ultimate frisbee, etc.), creating a situation of success, forming Soft skills. Use of health-preserving technologies (breathing exercises, corrective exercises, meditation, stretching, etc.); participation in webinars, trainings, discussion of interesting articles, viewing of video presentations, interactive tasks, etc.; extensive use of the e-learning system Zoom, Google Meet, Moodle.
4.	Content calendar planning	Regularly publish information on social networks (Facebook, Instagram, Educational portal Moodle, etc.). Communication in chat. Tutoring online. Facilitation (support) online. This will help keep the attention of higher education seekers and keep them interested.
5.	Involvement of students and stakeholders in active interaction and encouragement of activity	Conduct online polls, discussions and debates on sustainable development and health-preservation using social media. Create an incentive system for higher education students who create their own content, for example through hashtags and challenges.
6.	Increasing the availability of information	Provide easy access to information on sustainable development and health-preservation strategies and resources. Post links to social networks on the website of the department, university, and other resources. Conduct online lectures, master classes, round tables, guest lectures, international conferences on the Zoom, Google meet platforms.
7.	Training and non-formal education	To provide higher education seekers with the opportunity to study and deepen their knowledge about sustainable development and health-preservation through online webinars, training programs, training under double degree programs, online courses, video conferences, etc.
8.	Monitoring of current events	Constantly update content and adapt it to current events and issues related to health care and sustainable development. It is important to respond to recent events and include them in your strategy.
9.	Using video and live streaming	Conduct quizzes, online webinars, interactive lectures and interviews on live platforms where youth can interact and ask questions in real time.
10.	Constant communication and feedback	Provide an opportunity for students to ask questions, suggestions and feedback. Respond to their needs and expectations in a timely manner.
11.	Invitation of experienced specialists and experts	Consider inviting experienced specialists to guest lectures, health and sustainable development experts to your pages in social networks to conduct webinars, discussions or interactive lectures. This can enrich the content and provide students with the opportunity to communicate directly with specialists.
12.	Open sources	Use open educational resources (Open Educational Resources, OER) to provide students with access to free materials and textbooks on the organization of a health-preserving environment and sustainable development.
13.	Research projects	Provide higher education students with the opportunity to conduct research on topics related to the use of health-preserving technologies and present the results in the form of a scientific paper or presentation.
14.	Monitoring and feedback	Constantly monitor the reaction of higher education applicants to our content and strategy. Analyze comments, reviews and ratings to improve the quality of the educational process.
15.	Preservation of health and safety of oneself and others	Observance of hygienic measures is the most important feature of people's life in the conditions of a pandemic. And learning online also brought to the fore the ability to protect yourself from cyberbullying.
16.	Cooperation with student and public organizations	Engage students and stakeholders in sharing ideas and resources on health and sustainable development. Find partners for joint projects among educational institutions and public organizations.

The implementation of the process of educating the social activity of student youth takes place through the integration of various types of activities (Table 2).

Therefore, education of students' social activity is carried out not only during studies, but also in extracurricular, leisure activities. Educational hours, beauty and health festivals, flash mobs and social projects have been introduced by group advisors in higher education institutions: «My value orientations», «Olympic week», «I am for a healthy lifestyle», «Believe in yourself» festival, «Beauty and health», «Respect by action» training, holding student and student leagues «JuniorS Games» and others. At the same time, the educational portal «Moodle» (83.3%) and Zoom (77.8%) were the most popular among students at Luhansk Taras Shevchenko National University. Zoom (82.4%), Google Meet (64.2%) are popular among students at the Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council.

So, during the survey, we received information about the use of free time by students, taking into account preferences. Indicators of the preferences of student youth indicate, almost unanimously in all educational institutions involved in the experiment, showed that first place was taken by Internet leisure (social networks) and in second place were health-preserving technologies. The following research results were obtained (Table 3).

Next, we will consider the possession of future specialists in physical education and sports with the skills and abilities of health-preserving activities (Table 4).

The survey showed that future specialists in physical education and sports at the beginning of the experiment possessed skills and abilities in the following percentage ratio: «Recreational activity» by 58.3% of CG respondents and by 58.7% of EG respondents; a small percentage of CG students – 28.1% and EG – 28.3% have «Selection of exercises to restore mental and physical performance» ability; «Independent preparation for recreational and health-oriented classes» (CG – 35.4%, EG – 37.1%); «Application of health-preserving technologies and organization of physical culture and health activities with student youth» (CG – 40.6%, EG – 41.7%); «Control of your physical condition using a self-monitoring diary» (CG – 25.5%, EG – 26.8%);

Table 2. Implementation of the process of educating students' social activity through various activities

Type of activity	Activity content
Game activity using game technologies	Makes the education seeker feel like an equal member of society. Confidence in one's own abilities, in the ability to get a real result, appears in the game.
Research activity	Gives the student the opportunity to analyze events, independently find solutions or refutation of their own ideas.
Educational activity	Satisfies the cognitive interests of young people, to acquire relevant skills and abilities
Observation	Enriches the experience of students of higher education, stimulates the development of cognitive interests, gives birth to and consolidates social feelings.
Communicative (communication), social networks	Unites the teacher and student, users of social networks, meets the various needs of the student community in emotional intimacy with an adult, in his support and assessment.
Project activity	Activates the independent activity of the student of higher education, ensures the combination and integration of various types of activities.
Constructive activity	Makes it possible to form complex mental actions, creative imagination, mechanisms for managing one's own behavior.
Student self-government	A means of organization of the student community's rights and responsibilities, manifestation of leadership qualities, initiatives through decision-making and active cooperation with the management of the educational institution.

Table 3. The results of the study on the rational use of free time of young men and women at the ascertainment stage of the experiment

Preferences	SI LNU Poltava		CI KhHPA Kharkiv		PDMU Poltava	
	n=110		n=106		n=104	
	Boys,%	Girls,%	Boys,%	Girls,%	Boys, %	Girls,%
Different types of motor activity	60.7	55.5	65.0	45.6	49.0	44.8
Travels	8.8	11.1	23.8	28.0	19.6	31.0
Internet leisure (social networks)	51.9	70.3	69.8	64.9	62.7	65.5
Hobbies (activities of interest)	15.2	48.1	33.3	68.4	21.5	51.7
Health-preservation technologies	64.5	62.9	79.3	61.4	74.5	44.8
Recreational activity, recreation in nature	55.7	55.5	55.5	50.8	50.9	58.6

Table 4. Possession of future specialists in physical education and sports with the skills and abilities of health-preserving activities

№	Skills, abilities	The beginning of the experiment	
		CG (n=160)	EG (n=160)
		%	%
1.	Recreational activity	58.3	58.7
2.	Selection of exercises to restore mental and physical performance	28.1	28.3
3.	Independent preparation for health-preservation, recreational and health-oriented classes	35.4	37.1
4.	The use of health-preserving technologies and the organization of physical culture and health activities with schoolchildren	40.6	41.7
5.	Control your physical condition using a self-monitoring diary	25.5	26.8
6.	Cooperation with public organizations, physical culture and sports projects, arrangement of family sports grounds	23.9	27.8
7.	Organization of health days, tourist trips, gatherings	20.3	24.2
8.	Organization of online conferences, webinars, trainings, workshops, flash mobs, beauty and health festivals.	9.4	9.8

Table 5. The dynamics of changes in the possession of future specialists in physical education and sports with the skills and abilities of health-preserving activities

№	Skills, abilities	The beginning of the experiment		The end of the experiment		Increase	
		CG	EG	CG	EG	CG	EG
		%	%	%	%	%	%
1.	Recreational activity	58.3	58.7	68.2	84.0	9.9	25.3
2.	Selection of exercises to restore mental and physical performance	28.1	28.3	60.9	76.8	32.8	48.5
3.	Independent preparation for health-preservation, recreational and health-oriented classes	35.4	37.1	70.3	78.3	34.9	41.2
4.	The use of health-preserving technologies and the organization of physical culture and health activities with schoolchildren	40.6	41.7	62.2	77.8	21.6	36.1
5.	Control your physical condition using a self-monitoring diary	25.5	26.8	55.2	66.0	27.7	39.2
6.	Cooperation with public organizations, physical culture and sports projects, arrangement of family sports grounds	23.9	27.8	39.6	54.1	15.7	26.3
7.	Organization of health days, tourist trips, gatherings	20.3	24.2	36.9	50.5	16.6	26.3
8.	Organization of online conferences, webinars, trainings, workshops, flash mobs, beauty and health festivals.	9.4	9.8	35.9	57.7	26.5	47.9

«Cooperation with public organizations, physical culture and sports projects, arrangement of family sports grounds» (CG – 23.9%, EG – 27.8%); «Organization of health days and tourist trips» (CG – 20.3%, EG – 24.2%); «Organization of online conferences of master classes, flash mobs, beauty and health festivals» (CG – 9.4%, EG – 9.8%).

The dynamics of changes in the possession of future specialists in physical education and sports with the skills and abilities of health-preserving activities is presented in Table 5.

Therefore, we observe the greatest increase in the selection of exercises to restore mental and physical capacity (48.5%, EG) and the organization of online conferences, webinars, trainings, master classes, flash mobs, beauty and health festivals (47.9%, EG).

Students and teachers of the Educational and Scientific Institute of Physical Education and Sports of Luhansk Taras Shevchenko National University are representatives of the Public Organization «Sports Union of Schoolchildren and

Students of Luhansk Region» and the Luhansk Regional Branch of the Committee on Physical Education and Sports of MONU, take an active part in public events, such as: #OlympicLab, «Chat with champions» as part of All-Ukrainian sports and health events «Side by Side» with the support of the President of Ukraine Volodymyr Zelenskyi, #sports #unification, #student sport etc. Students of the Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council and members of Kharkiv Regional Children's Public Organization «Sports and Health Center «GRACIA» are representatives of the branch of the NOC of Ukraine in the Kharkiv Region. They are active participants of the Ukrainian-Swiss project «Be active for the sake of peace!».

DISCUSSION

According to health-preservation activities in a higher education institution include monitoring the state of health of students, creating and implementing programs for the formation healthy life-style (HLS), prevention of addictive behavior caused by addiction to false passions, physical culture and health and psychological and psychotherapeutic activities to improve the health of students, etc [5].

On the other hand considers health-preserving education as a pedagogical process during which students of higher education develop a valuable attitude to health, special knowledge and skills, as a result of which they develop skills and abilities to carry out diagnostic, preventive and corrective measures [6].

We support the opinion who considers the health-preserving educational environment of a higher education institution as the creation of pedagogical conditions for educational activities, the implementation of which ensures the preservation of the health of students, as indicators of the effectiveness of the management of a health-preserving environment. This is facilitated by the reduction of student morbidity, the state of comfort during studies at a higher education institution, the increase of their physical and mental capacity, and the formation of a healthy lifestyle [7-10].

The creative potential of future physical education teachers can be revealed if they master modern health-preserving technologies aimed at forming the student's health-preserving competence, which is based on the principles of prioritizing the health of the subjects of the educational process [8].

We consider the health-saving competence of students of higher education as a multifactorial personality quality that integrates knowledge, abilities, skills, experience and personal qualities, which are very important factors for achieving high results in future professional activities; motives, attitudes and values aimed at realizing the importance of health, a healthy lifestyle for the life of an individual, creating a health-preserving environment and health-preserving behavior of students in a higher education institution and improving one's own creative potential [11-15].

Various innovative technologies can be used in the training of future physical education teachers to improve the quality of education and increase student motivation. For example: 1) interactive learning methods – video lessons, online tests, virtual laboratories, etc.; 2) special training and data analysis software that allows you to access and explore large amounts of information; 3) internet resources for expanding learning opportunities (video lectures, e-books, magazines, etc.); 4) the latest technologies – virtual and augmented reality, allowing you to immerse yourself in a certain situation; 5) social networks and platforms for learning and communication, which allows you to discuss certain material, exchange ideas and receive feedback from colleagues [16-18].

As Shynkaryova notes, the content of the extracurricular activities of future specialists in physical education and sports in the health-preserving environment of the educational and scientific institute of physical education and sports of the State Institution «Luhansk National University named after Taras Shevchenko» is implemented in the field of «leisure and recreational activities» and has the following functions [11]: acquisition and expansion of knowledge; deepening of acquired knowledge; overcoming the disadvantages of classroom training; improvement of professional skills of bachelors of physical culture and sports for leisure and recreational activities; development of intelligence and personality; involvement in cultural values; reasonable spending of leisure time; self-education and self-development; satisfaction of communication needs; engaging in scientific research activities in health fitness and recreational tourism (Table 6).

So, for example, in the state institution «Luhansk National University named after Taras Shevchenko» the Educational Portal «Moodle» and the Digital Repository of LNU are widely used, which significantly help students to master the educational components of academic disciplines faster, perform practical and creative tasks qualitatively, improve self-control and self-education skills. In the Municipal Establishment «Kharkiv Humanitarian Pedagogical Academy» of Kharkiv Regional Council «interactive lectures or practical classes are becoming more and more relevant in the conditions of distance learning, which allow you to combine the leadership role of the teacher with the high activity of students based on the use of modern interactive technologies (the popular application Zoom, where you can lectures and practical classes interactively or with a video demonstration of a personal example)» [10-12].

CONCLUSIONS

Social activity of students of higher education is a key factor in the social success of student youth. We proposed introducing webinars, trainings, challenges, social and international projects, the method of specific situations, modern ICT tools, the latest technologies in the mode of mixed and distance learning into educational work with students; creation of a health-preserving environment in institutions of higher education with the mandatory condition of active socialization of the individual.

In the conditions of distance learning, various forms of online classes in the form of video conferences, master

Table 6. Integral combination of types of classroom and extracurricular activities of future specialists in physical education and sports in a health-preserving environment

Improvement of educational components of educational disciplines	Work in recreation camps, fitness centers, rehabilitation centers	Research and scientific work	Creative laboratory	General institute and faculty events
Health-preserving technologies in physical education and sports. Pedagogical diagnosis of training in physical culture. Organization of recreational and sports mass work. Theory and technologies of health and recreational motor activity. Organization of tourism and health activities. Basics of health and rational nutrition. Fitness technologies and recreation. Active and recreational games. Sports medicine with the basics of physical culture and sports rehabilitation. Paramedic medical care, etc.	Involvement of students in the future profession of a teacher, lecturer, trainer, rehabilitator, fitness instructor, etc. Improvement of professional skills.	Culture of health. Development of moral and personal culture. Formation of an active life position. Involvement of student youth in the creative process. Increasing the culture of mental work. Inculcation of scientific and research work skills. Participation in institute, All-Ukrainian, International scientific conferences.	Increasing students' interest in future professional activities. Values of health care and successful use of health care technologies in practical activities. Improvement of professional skills. Self-education and self-development. Satisfying communication needs, including in social networks. Active leisure time.	To contribute to the comprehensive development and education of the social personality. The prestige of the profession of physical education and sports specialist, rehabilitator. Improvement of abilities and skills that form valuable qualities of the student's personality. Development of general erudition of students. Experience of collective activity and cooperation. Formation of «soft skills».

classes, trainings, and online programs on various types of motor and physical activity are used in classes on physical education of student youth. Following can be designed for this:

a) online fitness program: this can be a program with various exercises and exercises for muscle development, cardio, stretching. This program can be hosted on a learning platform and made available to students who can do these exercises at home;
b) organize virtual yoga and meditation classes: this can help students reduce stress and focus, as well as strengthen muscles and increase body flexibility;
c) provide exercise and training advice: teachers/coaches can send instructions for various exercises that students can do at home. These instructions may include videos, images, and textual descriptions of the exercises;
d) develop a special program of healthy nutrition: healthy nutrition is an important element of physical education, as it helps to strengthen health and preserve energy. Learners can receive healthy eating tips through an online learning platform or emails;
e) promote physical activity at home: teachers can provide advice on physical activity at home and during active leisure activities;
f) organization of therapeutic groups: students can become participants in therapeutic groups that contribute to the maintenance of the psychological state and the development of social-emotional skills. Activity groups can include different forms of work, such as: discussion, role-playing and recreational games, meditation, relaxation techniques, stretching and others. Relaxation techniques such as yoga, meditation, breathing exercises (oxysize, bodyflex, etc.) contribute to improving the work of the cardiovascular system and reducing stress;
g) psychological trainings with the invitation of a psychologist: discussions to discuss issues related to the support and development of the psycho-emotional state of young people during martial law.

In order to increase the effectiveness of classes following should be implemented:

a) to activate the participation of teachers, students and scientists in the development and implementation of projects and programs for the creation of a health-preserving environment;
b) successfully develop and deepen international, interuniversity cooperation based on the implementation of joint scientific programs, grants, trainings;
c) training exercises to focus on relaxation, mutual understanding, communication, empathy;

d) use information and communication technologies and social networks for professional development and self-development, improving the quality of the educational process in higher education institutions;
e) to inform the international environment about the activities of higher education institutions through the official website, social networks, information booklets in English;
f) participation of teachers, students and scientists in international projects, forums, conferences with the involvement of foreign specialists for the exchange of experience.

Expected results: active marketing policy overcoming the negative impact of the war on the development of the university; participation in grant projects, international educational programs; publications of articles in international scientific journals, which are indexed in the international databases Index Copernicus, Scopus, Web of Science; fundraising; involvement of resources necessary for the implementation of projects and grants; the positive influence of the university on the sustainable development of territorial communities, regions, countries, etc.

Among the proposals for teachers of higher education institutions, one can single out: create a group or page for the course (educational component of the academic discipline); provide students with video recordings of lectures and online consultations; discussion of the topics of lectures and practical classes; joint work on projects through social networks; informing learners about important events and updates; encouraging students to interact and engage in research work; consulting on writing theses and articles; participation in conferences, online webinars, trainings, master classes; monitoring of students' success; receiving feedback.

Therefore, in order to create a health-preserving environment in a higher education institution, it is necessary to constantly self-develop and self-improve, to maintain a positive atmosphere, be ready for changes, analyze, master the skills of modern information and health-saving technologies, provide the possibility of online consultations through social networks, encourage young students to give feedback on the course and the way it is delivered through online surveys on social networks. This will help to significantly improve the quality of education.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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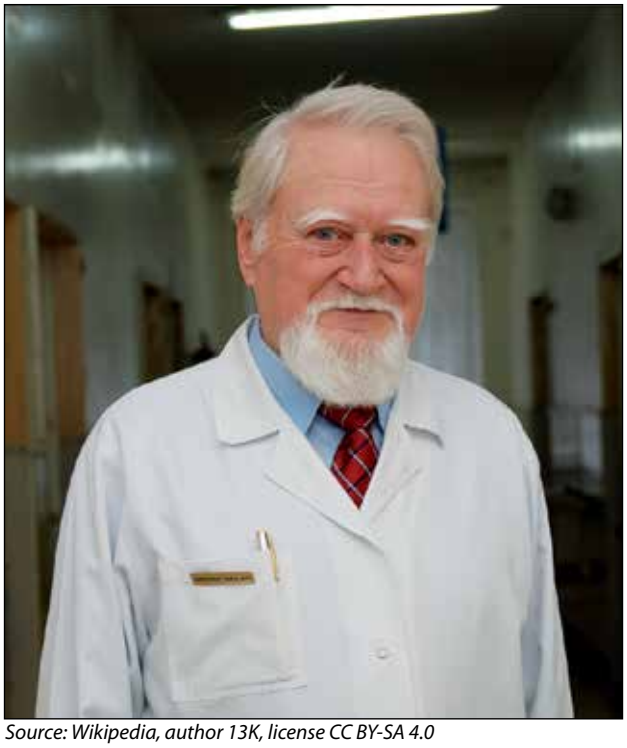

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Professor Jerzy Kiwerski graduated from the Faculty of Medicine at Pomeranian Medical University in Szczecin in 1963. He was a specialist in rehabilitation, trauma surgery and orthopedics. Throughout his life he was related to Konstancin. In 1965 he began working at Stołeczne Centrum Rehabilitacji rehabilitation center. In 1967, thanks to his dedication to work and research, doc. Marian Weiss employed him in the new STOCER base of Medical Academy Rehabilitaion Clinic. Between 1967 and 1977 he was an assistant, senior assistant and associate professor in the Clinic. In 1971 he earned his doctoral degree with the thesis „Damage to peripheral nerves". In 1975 he earned medical science habilitation in the field of motor organ disease (thesis: „Attempt of increasing the usefulness of tetraplegic patient's hand by nerve transplantation and stimulator implantation"). During this period he became the head doctor in spine trauma of Stołeczne Centrum Rehabilitacji in Konstancin (1973-1999). Between 1992 and 1998 he was the chief director of the center. He was related to Konstancin also in private life, having chosen this resort as his place to live.

He worked in Medical Academy in Warsaw. Between 1982 and 2008 he was the head of Rehabilitation Clinic. In 1984 he was recognized as an associate professor. In 1999 the Minister of Health nominated him as full professor. Between 1982 and 2002 he was consultant in medical rehabilitation for the region of Mazowsze.

Professor Kiwerski was the Rector of High School of Rehabilitation in Warsaw. He is the author of 570 research papers and 70 textbooks. He led the specialization in medical rehabilitation, trauma surgery and orthopedics of over 90 physicians. He promoted 24 doctors and supervised 3 habilitaions.

Professor Kiwerski was a member of numerous scientific bodies in Poland and abroad, therein: the New York Academy of Sciences, European Board of Physical Medicine and Rehabilitation, Research Board of Advisors of the American Biographical Institute, International Medical Society of Paraplegia, European Spine Society and International Rehabilitation Medical Association. He participated in work of scientific boards of journals: „Chirurgia Narządów Ruchu i Ortopedia Polska", „Ortopedia Traumatologia Rehabilitacja", „Postępy Rehabilitacji", „Acta Balneologica" („Balneologia Polska") and „Fizjoterapia Polska".

He was distinguished by International Biographical Center and American Biographical Center by numerous honors and diplomas, therein the "2000 Outstanding Intellectuals of 20th Century", "2000 Outstanding Scientists of the 21st Century" and "Man of the Year 2001". He was listed among "The 100 Most Intriguing People of 2003", "The Genius Elite – July 2004" and „Man of the Year 2004".

Professor Jerzy Kiwerski was an exceptional man, specialist of the highest level in orthopedics and rehabilitation and the Friend of ours,

dr n. hum. Anna Łuczyńska
Acta Balneologica journal publisher
and the editorial team

CONFERENCE REPORT

„New horizons of rehabilitation in various spheres of human life"

On April 26-27, 2024, a conference entitled „New horizons of rehabilitation in various spheres of human life" was held in the picturesque Kazimierz Dolny. This is the twelfth edition of this event, which is organized annually by Eres Medical Sp. z o. o. in cooperation with the Lublin Branch of the„Physiotherapy Poland„ Association and the Lublin Voivodeship Branch of the Polish Physiotherapy Society. Media patronage of the „Acta Balneologica" journal

The conference was opened with an introductory lecture by the National Consultant in the Field of Medical Rehabilitation, prof. dr hab. n. med. Małgorzata Łukowicz. During scientific lectures, innovative therapeutic approaches were presented that help improve patients' health, as well as the latest research on the effectiveness of modern physiotherapy. On the second day of the conference, practical workshops were held for interested participants.

During the entire conference, representatives of medical companies also presented modern devices and therapies supporting the rehabilitation process.

The 12th edition of the conference „New horizons of rehabilitation in various spheres of human life" turned out to be an very inspiring and informative event that contributed to expanding the participants' knowledge and promoting modern rehabilitation methods in Poland. This event was also an opportunity to integrate the Polish rehabilitation community. (ml)

Dear colleagues,

On May 30, 2024, a scientific and practical conference with international participation "Organisational and Clinical Aspects of Patient-Centred Approach to Treatment and Rehabilitation in Modern Conditions" will be held. The organisers of the conference are the State Institution of Science "Scientific and Practical Center of Preventive and Clinical Medicine" State Administrative Department, the National Academy of Medical Sciences of Ukraine, the Ukrainian Military Medical Academy and the Public Organisation "Ukrainian Association of Healthcare Management".
Publication of articles and abstracts in the professional journal "Clinical and Preventive Medicine" (SCOPUS) (Kyiv, Ukraine)
(http://cp-medical.com/index.php/journal).

The programme issues of the conference:

1. Interdisciplinary aspects of medical and non-medical methods of rehabilitation of military personnel-combatants.
2. Topical issues of rehabilitation of civilians who have suffered as a result of the impact of stress and physical destructive factors of war.
3. Organisational and clinical aspects of the use of various rehabilitation types in modern practice of internal medicine.
4. Comorbidity in military personnel: the current state of the problem (topical issues of diagnosis, treatment and rehabilitation).
5. Theoretical and applied aspects of reflexotherapy in the complex rehabilitation of military personnel and civilians who have suffered as a result of war.
6. Features of the application of complex rehabilitation programmes in patients with acute cerebrovascular accident.
7. Modern approaches to the treatment and rehabilitation of patients with pathological changes caused by coronavirus infection (COVID-19).
8. Features of medical rehabilitation of patients with pain syndromes of different localisation.
9. Organisational and clinical aspects and perspective directions of medical rehabilitation after surgical interventions.
10. Clinical approaches to the treatment and rehabilitation of patients with mine-blast trauma.
11. Modern principles of perioperative management of patients and rational anaesthetic accompaniment in surgical practice.
12. Topical questions of rehabilitation at different stages and levels of medical care.
13. Problematic issues of interprofessional and long-term rehabilitation in primary health care.
14. The current state of integration of rehabilitation into primary health care.
15. Experience in implementing European training standards in the system of training medical personnel in the field of health care.

Media partners of the conference:
1. ALUNA Publishing House (Warsaw, Poland).
2. Journal "Clinical and Preventive Medicine" (SCOPUS) (State Institution of Science "Scientific and Practical Center of Preventive and Clinical Medicine" State Administrative Department, Kyiv, Ukraine).