



JOURNAL OF THE POLISH
BALNEOLOGY AND PHYSICAL
MEDICINE ASSOCIATION

Acta Balneologica

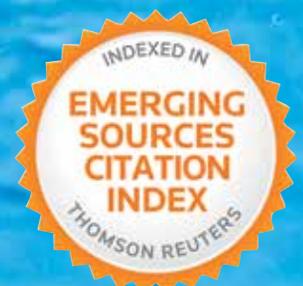
Published since 1905

ISSN 2082 - 1867

2023 NOVEMBER-DECEMBER VOL. LXV NUMBER 6 (178)

● HEALTH-RESORT MEDICINE ● PHYSICAL MEDICINE ● BIOCLIMATOLOGY

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ISSN 2082-1867

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PUBLISHER:

ALUNA Publishing
29 Z.M. Przesmyckiego St.
05-510 Konstancin Jeziorna, Poland
www.actabalneologica.pl

PROJECT COORDINATOR:

MEDDOM PRESS
tel. 604-208-453
barbadom@wp.pl

GRAPHIC DESIGN:

Piotr Dobrzyński
www.poligrafia.nets.pl

SUBSCRIPTION:

prenumerata@wydawnictwo-aluna.pl

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The journal is indexed in Web of Science – ESCI (IF 0.3), Index Copernicus, EBSCO,
Ministry of Education and Science and the Polish Medical Bibliography

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Acta Balneologica

bimonthly journal

www.actabalneologica.eu

The journal „Acta Balneologica” is cofinanced under Contract No.RCN/SN/0715/2021/1 by the funds of the Minister of Education and Science

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PECULIARITIES OF DIABETES MELLITUS IMPACT ON THE EFFECTIVENESS OF CARDIAC REHABILITATION OF PATIENTS WITH CORONARY HEART DISEASE AFTER MYOCARDIAL REVASCULARIZATION

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ABSTRACT

Aim: To investigate the impact of diabetes mellitus on the course of the disease, the quality of rehabilitation measures and the psycho-emotional state of patients.

Materials and Methods: The study involved 134 patients, who were divided into four groups depending on the method of revascularization and the presence or absence of diabetes mellitus. The patients underwent a 21-day rehabilitation programme, at the beginning and at the end of which they were assessed for left ventricular ejection fraction, exercise tolerance, maximum oxygen consumption, and treatment adherence. Throughout the study, the patients were under the supervision of a psychologist.

Results: The study found that patients with diabetes showed a significant improvement in the measured indicators, but to a lesser extent than patients without diabetes.

Conclusions: The mechanisms of poorer outcomes in patients with diabetes are mostly related to psycho-emotional factors as a result of the diagnosed disease, but they require further study.

KEY WORDS: cardiorehabilitation, diabetes mellitus, coronary artery bypass grafting, acute coronary syndrome, stenting

INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of morbidity and one of the main causes of mortality in the world and in Ukraine [1]. Today, coronary heart disease (CHD) is one of the most common diseases worldwide and the leading cause of death among the population of different countries.

CHD is a chronic disease that combines angina, myocardial infarction (MI) and atherosclerotic cardiosclerosis. In the majority of cases (97-98%), coronary heart disease is the result of atherosclerosis of the coronary arteries. Without sufficient blood flow from the coronary vessels, the heart muscle does not receive enough oxygen and vital nutrients which are necessary for the heart to function properly.

CHD is a disease that progresses rather slowly and has several well-studied causes: it has been proven that the incidence of CHD is directly proportional to the level of total blood cholesterol; smoking (it increases the risk of developing CHD by 60%); arterial hypertension (AH); diabetes mellitus (DM) increases the risk of developing CHD by 50% in men and by 100% in women. This is associated with

increased total blood cholesterol levels, platelet adhesion, and genetic predispositions [2].

For this reason, coronary heart disease and the methods of its correction and treatment are among the most important problems of the 21st century.

Almost 40 years of experience in the surgical treatment of coronary artery disease shows that patients with coronary artery disease and concomitant diabetes mellitus have worse morbidity and mortality rates compared to patients without diabetes. Macrovascular complications are one of the leading causes of death in patients with diabetes.

AIM

To determine the main features of cardiac rehabilitation in patients with concomitant diabetes mellitus after myocardial revascularization.

MATERIALS AND METHODS

PATIENTS

The study was conducted at the Rehabilitation and Planned Cardiology Department (RPC) of the Poltava Regional Clinical

Medical Cardiovascular Centre of the Poltava Regional Council (POCMCC PRC) between 1 March 2022 and 1 March 2023. The study involved 134 patients. The inclusion criteria were as follows: STEMI with PCI with coronary artery bypass grafting (CABG) and patients with chronic coronary artery disease (CAD) revascularised by cardiac surgery – CABG. The presence of diabetes mellitus influenced grouping patients. All patients were divided into 4 groups: Group 1 – patients with STEMI who were revascularised by CABG without concomitant diabetes mellitus; Group 2 – patients with STEMI who were revascularised by CABG with concomitant diabetes mellitus; Group 3 – patients with coronary artery disease revascularised by CABG without concomitant diabetes mellitus; Group 4 – patients with coronary artery disease revascularised by CABG with concomitant diabetes mellitus. The distribution of patients by gender and age, as well as their percentage distribution by group, is presented in Table 1.

CARDIAC REHABILITATION (CR) PROGRAMME

An innovative individualised rehabilitation model was introduced to all study patients. CR began with preoperative preparation of patients (for CABG) and from the first days

of their stay in the intensive care unit (for patients with AMI) and continued during their hospital stay and for 21 days after their discharge (outpatient monitoring stage of rehabilitation).

The rehabilitation model we propose is based on an individualised multicomponent and multidisciplinary approach. The multidisciplinary team consists of a cardiologist (in most cases, the primary care physician), a physician of physical and rehabilitation medicine (PRM), a cardiovascular surgeon, a physiotherapist, an endocrinologist (for patients with diabetes), a psychologist, a physical therapist, an occupational therapist, and, if necessary, a spiritual director (according to the patient’s religion). The rehabilitation model that was implemented included many components, namely [3-5]:

Prehabilitation: this component of the rehabilitation model was used in patients with coronary artery disease who underwent revascularization by CABG. Prehabilitation was technically impossible for patients with ACS (patients with ACS are patients with an acute coronary event who were taken to our institution by ambulance). Prehabilitation included preoperative preparation of the patient, namely,

Table 1. Gender and age distribution of the study patients

	Group 1 n=45	Group 2 n=45	Group 3 n=23	Group 4 n=21
Male	n=35 (26,1%)	n=21 (15,7%)	n=18 (13,4%)	n=10 (7,5%)
n=84 (62,7%)	66,74±1,48	63,2±1,76	65,83±1,52	65,0±1,89
65,54±1,17 years	years	years	years	years
Female	n=10 (7,5%)	n=24 (17,9%)	n=5 (3,7%)	n=11 (8,2%)
n=50 (37,3%)	63,44±2,63	66,52±2,18	62,6±2,87	65,54±2,35
64,63±1,83 years	years	years	years	years

Table 2. LVEF indices at the beginning and at the end of rehabilitation measures

	Group 1 n=45	Group 2 n=45	Group 3 n=23	Group 4 n=21
Initial examination, %.	48,8±1,8	46,9±2,1	48,1±2,1	46,4±2,5
Upon completion of the rehabilitation cycle, %.	56,4±1,7	53,9±2,3	54,8±2,3	53,5±2,1
	p<0,01	p<0,05	p<0,05	p<0,05

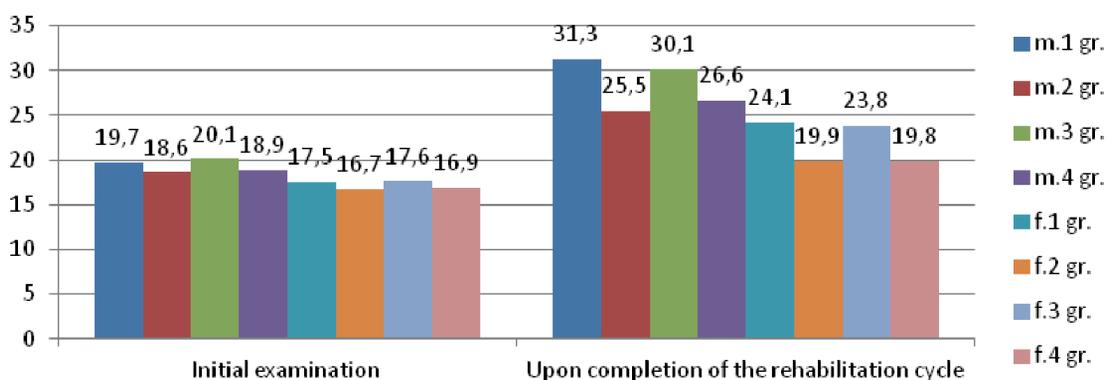


Fig. 1. Dynamics of VO₂ max(ml/kg/min) indicators in the process of rehabilitation by gender

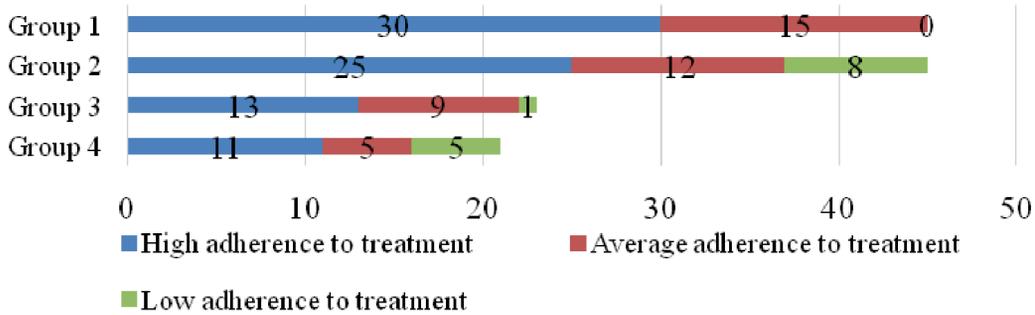


Fig. 2. Adherence to treatment of study patients after rehabilitation

primary conversation and familiarisation with the stages of surgery, stages of recovery, testing of rehabilitation methods which are planned for implementation in the early postoperative period, primary breathing exercises with explanation of the advantages and necessity of such exercises in the future, primary session with a physical and occupational therapist in order to master the basic physical exercises were later used, selection of an individual chest corset.

Educational component: during the CR, patients had regular educational discussions on secondary prevention, the benefits and necessity of lifestyle modification, rejection of bad habits, the basics of postoperative wound care after discharge from hospital, rules of the resumption of sexual activity after surgery, basic rules for using a breast corset and the terms of its use.

Respiratory component: we pay special attention to teaching patients how to breathe properly. We use breathing exercises that were mastered during the prehabilitation phase in patients after CABG. Patients after ACS start breathing exercises while they are still in the intensive care unit. Primary breathing exercises are performed under the supervision of a physical therapist and a physiotherapist, and further controlled breathing exercises are performed once a day. Subsequently, patients perform these exercises independently for 5-7 minutes every 2-3 hours. While they are performing breathing exercises, their attention is focused on the involvement of the diaphragm in the act of breathing, increasing diaphragmatic excursion, changes in the depth of breathing, which prevents congestion in the lungs. Breathing exercises include independent diaphragmatic breathing exercises, exercises to lengthen inhalation and exhalation, and breath-holding exercises. A modified and simplified Frolov breathing simulator was used to implement the respiratory component.

Physical component: every day, patients had physical therapy sessions with a physical therapist according to an individually designed schedule and selected load, taking into account the motor regime, degree of motor activity. Physical therapy sessions included: strength training with light resistance, as well as cardio training on an ergometer and a treadmill for 30-40 minutes 3 times a week. All training sessions were monitored: by blood pressure (BP), heart rate (HR), and electrocardiogram (ECG).

Medication component: medical cardioprotective support in accordance with the standards and protocols of the Ministry of Health of Ukraine.

Psychological component: at the prehabilitation stage, all patients before CABG are consulted by a psychologist, undergo primary testing and develop their psychological profile. Patients with ACS are consulted by a psychologist when they are transferred from the intensive care unit to the ACS. If necessary, psychotherapeutic work are conducted with patients to increase their motivation to modify their lifestyle and increase their adherence to treatment. The method of positive psychotherapy (PPT) was used. The method of positive psychotherapy is a globally recognised method of short-term psychotherapy aimed at mobilising a person's internal resources to make positive decisions in any, even the most difficult life situations, which also provides knowledge about a person, teaches not to fight the world around us, but to accept it in all its diversity [6].

The method teaches how to influence the future through the perception of present situations. Recognising personal responsibility for one's life helps everyone take concrete steps to change their reality.

CONTROL METHODS

Assessment of the effectiveness of rehabilitation measures was carried out by determining exercise tolerance (ET) by determining the functional class (FC) of heart failure (HF) using the 6-minute walk test (6MWT), left ventricular ejection fraction (LVEF), determination of the maximum oxygen consumption (VO_2 max) based on heart rate, determination of the level of treatment adherence using the Morisky Medication Adherence Scale (MMSA), psychological profile was determined using the Hospital Anxiety and Depression Scale (HADS). Testing of the study patients was carried out at the beginning of rehabilitation activities and at the end of the outpatient control stage of rehabilitation.

LVEF was determined using a GE LOGIQ F8 ultrasound machine manufactured in the USA.

Mathematical processing of the results was carried out using Statistica 8.0 software (StatSoft Inc, USA, licence number STA862D175437Q). The mean value (M), variance, mean standard deviation and median (m), and significance level (p) were calculated. The logistic regression method was used. The results were processed by calculating the

Student's t-test. A difference of $p < 0.05$ was considered statistically significant.

Written informed consent to participate in the study was obtained from all patients in accordance with the World Medical Association Declaration of Helsinki on the Ethical Principles of Scientific Medical Research Involving Human Subjects (1964-2008), European Society Directive 86/609 on the participation of human subjects in biomedical research, and Order of the Ministry of Health of Ukraine No. 690 of 23.09.2009, as amended.

The study was approved by the Ethics and Bioethics Committee of Poltava State Medical University. The study was performed as part of the research work of the Department of Internal Medicine No. 2 of Poltava State Medical University.

RESULTS

The results of the 6MWT test after completion of rehabilitation measures indicate a statistically significant higher index in patients without DM compared with patients with concomitant DM. Thus, the 6MWT index in patients of groups 1 and 2 was 355.3 ± 11.2 and 310.7 ± 11.3 m ($p < 0.01$), and in patients of groups 3 and 4 – 315.4 ± 9.3 and 284.6 ± 10.1 m ($p < 0.05$), respectively. These changes indicated a significantly higher rate of TFN in patients without concomitant DM, regardless of the method of revascularization. It should be noted a greater increase in the 6MWT test in patients without diabetes mellitus after completion of rehabilitation measures compared with the initial values. Thus, the increase in groups 1 and 3 was 69% (from 210.1 ± 10.8 to 355.3 ± 11.2 m) and 47% (from 214.2 ± 9.8 to 315.4 ± 9.3 m) compared with the indicators in groups 2 and 4, where the increase in TFP was less and amounted to 46% (from 212.4 ± 10.4 to 310.7 ± 11.3 m) and 34% (from 211.8 ± 10.4 to 284.6 ± 10.1 m), respectively.

According to the results of echocardiography, LVEF had a statistically significant ($p < 0.05$) growth dynamics in all groups, which indicated the effectiveness of rehabilitation measures (Table 2).

The VO_2 max values at the beginning of rehabilitation activities in all study groups were considered very poor (according to the Cooper Institute's VO_2 max norms), which is associated with violation coronary circulation and low-level exercise tolerance. The obtained results of VO_2 max after the course of medical rehabilitation showed a statistically significant increase in VO_2 max in patients of all four groups, which indicated the effectiveness of cardiac rehabilitation measures. VO_2 max after cardiac rehabilitation in patients without DM (groups 1 and 3) had a statistically significantly higher value ($p < 0.05$) compared with patients in groups 2 and 4 (patients with concomitant DM), which probably reflects a violation of the process of glycolysis intensity in patients with DM. The dynamics of VO_2 max with a gender distribution is shown in Fig. 1.

The analysis of HADS scores at baseline and at the end of the study revealed significantly higher rates of anxiety and depression in patients with concomitant diabetes mellitus compared with those in patients without diabetes.

Thus, the proportion of patients in group 1 with signs of subclinical anxiety was 55.5% compared with 77.8% in group 2. The same indicator in groups 3 and 4 was 52.2% and 81.0%, respectively. The rate of subclinical depression in groups 1 and 2 was 8.9% and 15.5%, and in groups 3 and 4 the same rate was 13% and 14.3%. The proportion of patients with HADS test results that were within the normal range by group was 35.6% (in group 1) compared to 6.7% (in group 2) and 34.8% (in group 3) compared to 4.7% (in group 4). The proportion of people with diabetes mellitus who suffered from depression and had increased anxiety was significantly higher compared with patients without concomitant diabetes, regardless of the conditions and method of myocardial revascularization. This has two primary causes: impaired glucose metabolism and presence of a serious chronic disease.

Unfortunately, our mentality is dominated by the idea that the doctor is responsible for the patient's health, and if the doctor cannot help the patient, then the doctor is bad. At the same time, the actions of the patients, their conscious willingness to follow the recommendations, and even more so, their actual implementation, are not considered important. If you explain to people that it is THEIR lives and health, and they are responsible for themselves, the effectiveness of diabetes treatment increases significantly. In this regard, exercise therapy is the best way to help people cope with diabetes.

That is why psychologists working with patients with concomitant diabetes conduct psychotherapeutic work to increase motivation to strictly follow a diet, adhere to a diet regime, take regular medication and, most importantly, to ensure that this trend continues after discharge and during further outpatient recovery.

According to the MMSA treatment adherence questionnaire, at the beginning of the study, the following data were obtained: at the beginning of treatment and before rehabilitation measures, 100% of study patients ($n = 134$) had a total score of 6 points on the MMSA scale, which indicated low treatment adherence. After completion of rehabilitation measures, repeated testing was performed, which showed that low adherence to treatment remained in 17.8% ($n = 8$) of patients in group 2 and in 23.8% ($n = 5$) of patients in group 4, which is most likely caused by the negative impact of diabetes on their general psychological state (Fig. 2).

DISCUSSION

In case of acute coronary events, patients undergo coronary angiography (CAG), stenting or angioplasty, while in case of multivessel coronary artery disease, coronary artery bypass grafting (CABG) is preferred. On average, about 40,000 heart attacks occur in Ukraine every year, 20,000 of which require emergency treatment (CABG and stenting) [2, 3].

Decision to myocardial revascularization in patients with diabetes has certain peculiarities. First of all, this is due to the fact that such patients usually have diffuse atherosclerotic lesions of the coronary arteries. In addition, in diabetes, there is a tendency to the development of restenosis after

percutaneous coronary intervention (PCI), shunt occlusion after CABG, and the formation of new stenoses as a result of atherosclerosis progression. All this is associated with a higher risk of complications in the future. Given the possible complications of the disease, diabetes mellitus is a very difficult disease to treat and rehabilitate. It not only changes the lives of patients, but also the lives of their families. Modern medicine can only partially help a patient to alleviate his or her condition, because, on the one hand, all the causes of the disease have not been fully understood yet, and on the other hand, and no less importantly, the psychological and personal aspects of the problem remain unresolved in the vast majority of patients [4,5]. Therefore, patients with diabetes are at increased risk for decline in psychological well-being, which is observed in about half of patients at the time of diagnosis; anxiety and/or depression may develop [3].

When choosing revascularization methods, CABG is considered to be preferable to PCI for patients with progressive coronary artery disease and diabetes mellitus. However, if urgent revascularization is required in acute coronary syndrome (ACS), PCI is performed according to generally accepted indications.

CABG surgery is the most common type of cardiac surgery. More than 1.5 million such operations are performed

worldwide every year. According to the Association of Cardiovascular Surgeons, more than 24,000 cardiac surgeries are performed in Ukraine every year. Given this volume of surgical interventions for CVD, there is the question of the need to study the features of cardiac rehabilitation after revascularization in patients with diabetes [4].

CONCLUSIONS

The majority of patients with concomitant diabetes mellitus in ACS and CHD who required myocardial revascularization were women.

Comprehensive cardiac rehabilitation is effective in patients with and without concomitant diabetes mellitus.

The effectiveness of CR measures was confirmed by the improvement of LV systolic function with an increase in EF, a decrease in HF and an increase in LVEF, an increase in VO_2 max and an increase in adherence to treatment.

Lower rates of CR effectiveness in patients with concomitant diabetes mellitus compared with patients without diabetes mellitus, regardless of the method of revascularization, combined with a higher rate of anxiety and depressive disorders among patients with diabetes mellitus may be indicative of an additional impact of psychological state on the effectiveness of CR.

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The article was performed as part of the research work: «Clinical assessment of the combined effect of cardiovascular risk factors on the comorbid course of arterial hypertension, coronary heart disease and chronic kidney disease, features of prevention and rehabilitation», state registration number 0119U102851.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest.

RECEIVED: 11.05.2023

ACCEPTED: 22.10.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

ASSESSING THE LEVEL OF PAIN REDUCTION AND EXCESSIVE SOFT TISSUE TENSION IN PATIENTS WITH SELECTED LUMBOSACRAL SPINE CONDITIONS USING A PROTOTYPE FASCIAL THERAPY TOOL

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ABSTRACT

Aim: The purpose of the study was to assess the level of maximizing treatment effects by reducing pain symptoms and excessive tissue tension as the main pathogenic stimuli, and to minimize the potential adverse consequences of treating selected lumbosacral spine conditions.

Materials and Methods: The study material consisted of the results of questionnaires administered to patients of both sexes, aged 20-80 years, evaluated at the beginning and end of a standard 10-day rehabilitation camp. During it, an experimental method of fascial therapy using the prototype M-Stick tool was applied and compared with a control group whose treatment did not involve tool. The study used, among other things, palpation of subjective soft tissue tension levels and pain levels according to the VAS scale.

Results: After the 10-day therapy, more than 90% of patients achieved a reduction in soft tissue tension compared to the initial state, while pain levels measured according to VAS decreased from a mean of 6.5 to 3.3. In approximately 50% of the patients, the therapy resulted in moderate tissue bruising.

Conclusions: Fascial therapy using the specialized M-Stick tool achieves similar efficacy to technically identical therapy without the support of the tool, in the context of reducing pain and tissue tension. Despite leaving moderate tissue bruising in nearly 50% of patients, it is considered an acceptable therapy for treating selected lumbosacral spine conditions.

KEY WORDS: M-Stick, fascia, tool therapy, pain

INTRODUCTION

Physiotherapy, like any other medical discipline, is undergoing constant change to improve the complex view of the patient and to develop the methodology of working with specialised methods. However, whether it involves techniques shaping movement skills or methods directly interfering with the body structure, the basic condition is to take care of the patient's safety during its implementation and to achieve maximum effectiveness in the shortest possible time frame.

Lumbosacral disorders are one of the most common reasons for visiting a physiotherapist, with musculoskeletal disorders being an overwhelming condition of all musculoskeletal complaints [1]. Lower back pain effects on average two-thirds of adults and occurs already in about 85% of people before the age of 40 [2], while in older persons it ranks third among the most common musculoskeletal conditions [3].

Among the specialised direct methods to counteract this type of dysfunction, Fascial Therapy is implemented when warranted in the course of treatment, comprising

a range of techniques that normalise deformations in areas of the so-called Distortion [4]. This therapy allows for the use of additional tools to assist in the treatment of musculoskeletal restrictions by providing a mechanical advantage, allowing deep tissue penetration while reducing pressure on the therapist's hands [5].

Many myths have grown up around the efficacy of an instrument therapy questioning the level of control over the patient's soft tissue and the high risk of inducing microvascular damage and inflammation [6].

AIM

The aim of the study was to find an answer to the question of whether, with the use of the M-stick tool, it is possible to maximize the effects of therapy, which includes assessing the reduction of the level of pain and flexibility of soft tissues, as well as minimizing the potential adverse consequences of the treatment of selected lumbosacral spine disease entities, such as the level of generation of so-called "tissue bruising" encompassing all phenomena resulting from excessive pressure on the patient's soft tissues.

MATERIALS AND METHODS

PHYSIOLOGY

The subject of this study was the effect of instrument therapy on fascia; that is a connective tissue structure that covers muscles and internal organs, connecting them into a coherent whole and providing a glide and mobility between ligaments, muscles or bony elements [7]. According to some theories, fascia manages the balance between tension and compression around the tissues it surrounds. So, it is considered to be the structure that builds tension integrity [8].

Recent studies prove that fascia has more than just a passive role in force transmission. It has been proven that the fascia tissue contains contractile elements that play a modulating role in force generation, as well as in mechanosensory fine-tuning [9]. With this type of function, muscle-fascia connections can be directly effective in the organisation of movement and the transmission of muscular force [10]. In contrast, any movement disorders associated with active and persistent pathological changes within the fascia may include impaired motor function, muscle weakness as a result of inhibition of motor function, muscle stiffness and restriction of the range of motion. It will also result in pain experienced in response to a stimulus that does not normally cause it. Both active and persistent trigger points are painful on pressure [11].

In this type of pathology, when a stimulus is applied to the damaged soft tissue (trigger point distention or trigger band) with an instrument, the activity and number of fibroblasts together with fibronectin, through localised inflammation, increases, facilitating collagen synthesis and repositioning [6]. As a result, the 'fibrotic' tissue is released and regenerated and the transmission of tension to other regions

is reduced. Local blood and lymph circulation is improved. There is a reduction in hypertonia, segmental sensitisation at the level of the spinal cord and a gradual quieting of the sympathetic nervous system, as well as a decrease in negative feedback in the central nervous system [12]. Secondary effects of the therapy include improved local metabolism, compensation of symmetrical soft tissue tension and reduction of pain.

STUDY GROUP

The study material involved a group of 110 patients with one of the three selected lumbosacral spine conditions: spondyloarthritis, discopathy and pain syndrome of undetermined aetiology. Patients of both sexes ranging in age from 20 to 80 years eligible for testing took part in the 10-day rehabilitation camp under reimbursement from the Ministry of Health, during which soft tissue therapy with M-Stick was performed in 30-minute sessions (Fig. 1, 2). Due to the limitation of patient contact and the possibility of evaluating the research process only during the 10-day rehabilitation period, observation of the effects of the application of tool and tool-free techniques ended when the rehabilitation process ended. The study and control groups were selected over the widest possible age range due to the age-different responses of the soft tissue subjected to compression and the vascular dysfunction that progresses as a result of aging [13] causing differences in acceptable pain levels. The study did not take into account other relationships, such as occupational or practiced physical activities, focusing only on the tissue response during therapy. The potential efficacy of the M-Stick tool in the study group was compared to a control group of 100 subjects undergoing fascial therapy performed solely by a physical therapist's hand.



Fig. 1. M-Stick – side projection of the tool



Fig. 2. M-Stick – photo during treatment (photo with written consent of the patient)

INCLUSION AND EXCLUSION CRITERIONS

Inclusion criteria were complaints of lumbosacral spine pain with possible neurological symptoms confirmed by clinical tests and physical examination. The exclusion criteria were conditions that are general contraindications to fascial therapy, such as cancer, pregnancy, arthritis, skin lesions, aneurysms, atherosclerosis, infections and fever, undiagnosed trauma and incomplete attendance at a rehabilitation camp.

Also included among the exclusion criteria were patients with a low pain threshold, those not accepting pain stimuli during therapy, and patients pursuing other rehabilitation services at the same time.

EVALUATION AND RESEARCH METHODS

Patients participating in the study signed a written consent form. Each patient was assessed on the basis of a questionnaire at the beginning and end of the therapy. The overall usefulness and effectiveness of tool therapy was assessed taking into account factors such as:

1. Comparison of its effectiveness in specific conditions.
2. Degree of reduction of general complaints.
3. Degree of pain reduction measured according to the VAS scale.

4. Level of "tissue bruising" accompanying fascial therapy.
5. Comparison of frequency and necessity of hand and tool work.

The examination included the patient's assessment of pain intensity (VAS scale), qualification for potential vascular fragility and the presence of a subcutaneous hematoma based on the 5-degrees Bruise Visibility Scale (BVS), as well as a subjective assessment of soft tissue tension.

Medical science has a large number of questionnaires of subjective pain experience like:

"The Minnesota Multiphasic Personality Inventory and the McGill Pain Questionnaire", "The Health Assessment Questionnaire (HAQ) and its derivatives: the Modified Health Assessment Questionnaire (MHAQ)", "The Arthritis Impact Measurement Scales (AIMS)" [14], however, a very small base of objective methods.

Of the tools that objectively assess pain levels in the study, the following were used the Semmens-Weinstein Vein. The fiber is mainly used in assessing the condition of peripheral nerves and therefore superficial sensation and pain in the feet, among other things, in the diagnosis of diabetic neuropathy. The method is performed by pressing the vein perpendicularly to the skin surface until the vein

bends [15] in order to assess the quality of superficial sensation and possible pain responses. In the present study, the test was performed on patients reporting complaints in the L-S spine region in the course of selected medical conditions.

The results were compared with a control group undergoing fascial therapy without the use of additional tools. We used the STROBE cohort checklist when writing our report [16].

STATISTICAL ANALYSIS

Statistical analysis was prepared using STATISTICA v.13. The answers to the qualitative questions were presented as percentages. For the quantitative variables, descriptive statistics (arithmetic mean, standard deviation, minimum and maximum value) were calculated. A non-parametric test for dependent samples was used to detect statistically significant differences due to the selected characteristics of the respondents: Wilcoxon's pair-order test. The test of interdependence was performed using Sperman rank correlation. The study assumed a significance level of $p=0.05$ in all analysed cases.

RESULTS

Among the patients examined in the study group were 56 women and 56 men: 14 in the 20-30 age bracket, 18 in the 30-40 age bracket, 27 in the 40-50 age bracket, 31 in the 50-60 age bracket, 19 in the 60-70 age bracket, and three in the 70-80 age bracket. Of all the patients examined in the study group, the largest proportion were those with a diagnosis of intervertebral disc herniation (41%). The mean age of the patients was 48 years. As the analysis of the results shows, similar treatment efficacy was obtained regardless of the examined condition. The average pain level according to the VAS scale at the start of therapy was 6.48 in the study group and 7.01 in the control group, and after the end of treatment 3.3 in the

study group and 3,29 (Fig. 3) in the control group, which is a 48% and 53% improvement, respectively, with a slight advantage in effectiveness among women (Table 1). There was no significant tissue bruising or subcutaneous damage among the patients undergoing the therapy. The level of unpleasant sensations after the therapy was declared as "moderate" by about 49% of respondents. This compares with 31% in the control group (Fig. 4).

In the case of a subjective assessment of muscle tone before the start of the treatment, the level measured at the time of assessment was generally described as high (54.5%) and very high (22.3%), along with negligible flexibility and movability of soft tissues during palpation tests. On the other hand, after the 10 day-period of the therapy, the same factor was described mainly as low in 54.5% and moderate in 32.1% of the subjects (Fig. 5). At the same time, the most effective proportion of M-Stick therapy was mostly confirmed in a 50%-50% ratio with therapy without its use (Fig. 6, Fig. 7). This split accounted for 41% of all cases of the use of the tool. Among the rest of the respondents, the therapy took place predominantly with the therapy that does not require frequent use of the tool. As the proportion of the use of M-Stick therapy increased, its effectiveness decreased slightly, which suggests that the best results in fascial therapy are obtained when the therapist works proportionally both with the hand and with the tool.

The Semmens-Weinstein Fiber Test, with a size of 6.65 and a maximum load of up to 300g, used to deep pressure sensation, produced sensations in 97.32% of patients tested at the L-S level, i.e. 109 people, with only 1 person with a superficial sensory disorder among all those tested reporting VAS pain levels on palpation at the upper limit. The rest of the subjects who scored positive on the Semmens-Weinstein Fiber test reported pain at an average VAS level of 5. The above result may suggest

Table 1. VAS pain characteristics before and after the therapy

	study group	control group
VAS pain level before the therapy		
mean	6,48	7,01
standard deviation	1,64	1,12
minimum	3,00	5,00
maximum	10,00	10,00
VAS pain level after the therapy		
mean	3,30	3,29
standard deviation	1,33	0,89
minimum	1,00	1,00
maximum	7,00	5,00
Reduction in VAS pain levels after the therapy		
mean	3,18	3,74
standard deviation	1,68	
minimum	0,00	
maximum	8,00	
Relative reduction in VAS pain levels after the therapy		
mean	47,7%	53,07%
standard deviation	18,9%	
minimum	0,0%	
maximum	88,9%	

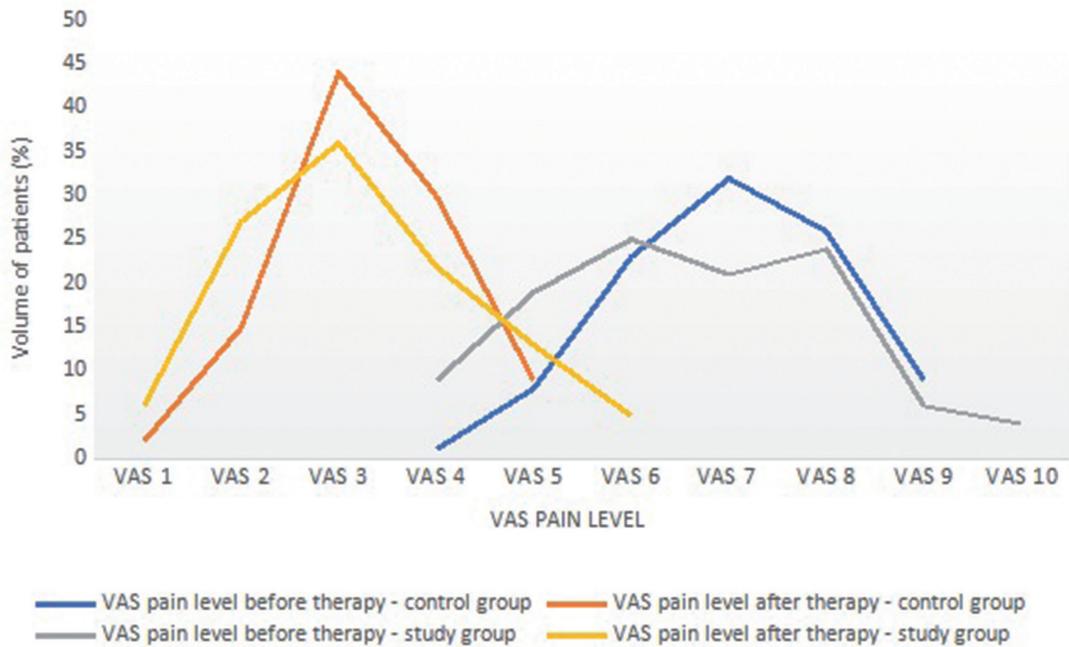


Fig. 3. VAS pain level before and after therapy in the study group and the control group

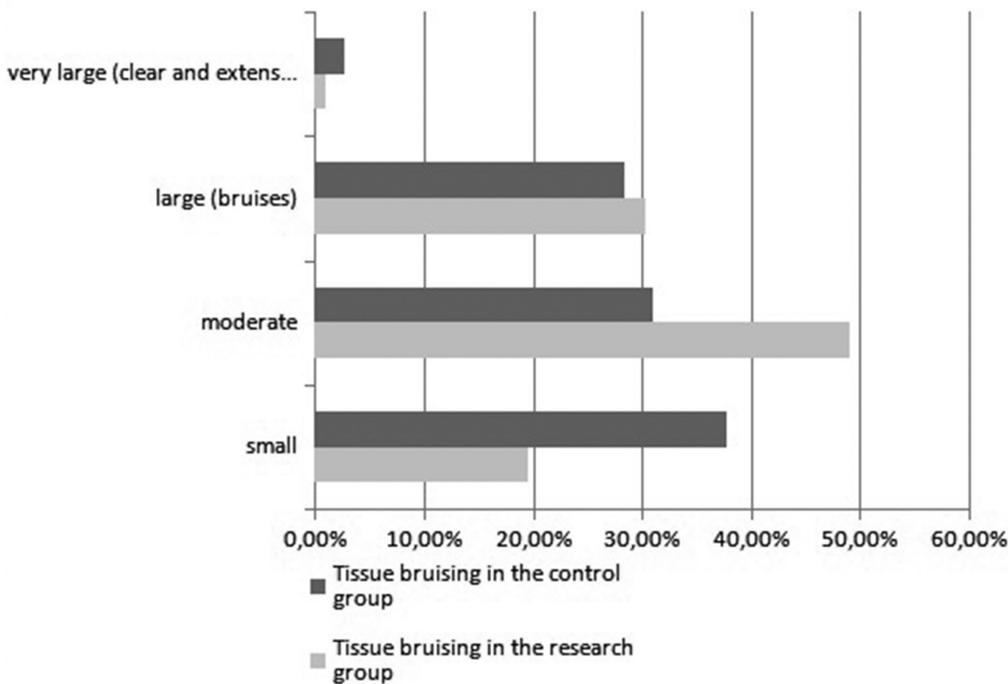


Fig. 4. Level of "tissue bruising" after therapy in the study and control groups

the presence of other, unconsidered comorbidities that may correlate with sensations from the superficial layers of the skin.

Since the Fiber is not equipped with a mechanism for measuring the exact loads and degree of deflection of the needle, providing only visual assessment of its deflection, it only provides information about sensory disturbances on the skin surface and possible initial pain stimuli at loads up to 300 g. Of the 97.32% of subjects feeling the pressure

of the "needle" at its maximum deflection, irritation of skin surfaces at the L-S level described as unpleasant/painful was reported by 88.07% of participants, or 96 people. The result indicates high pain excitability already at the skin surface and gives indications of stronger soreness in deeper musculo-fascial areas. Since the essence of the study was the evaluation of deep pain in thumb therapy and the prototype of the fascial therapy tool, the test result was considered of little relevance to the evaluation of

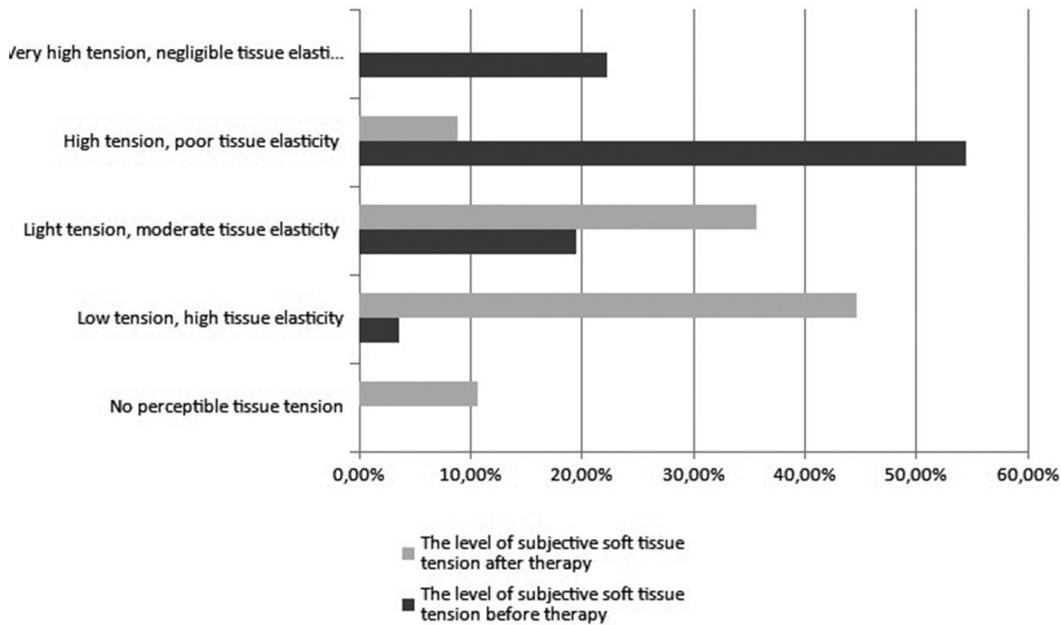


Fig. 5. Soft tissue tension level before and after therapy

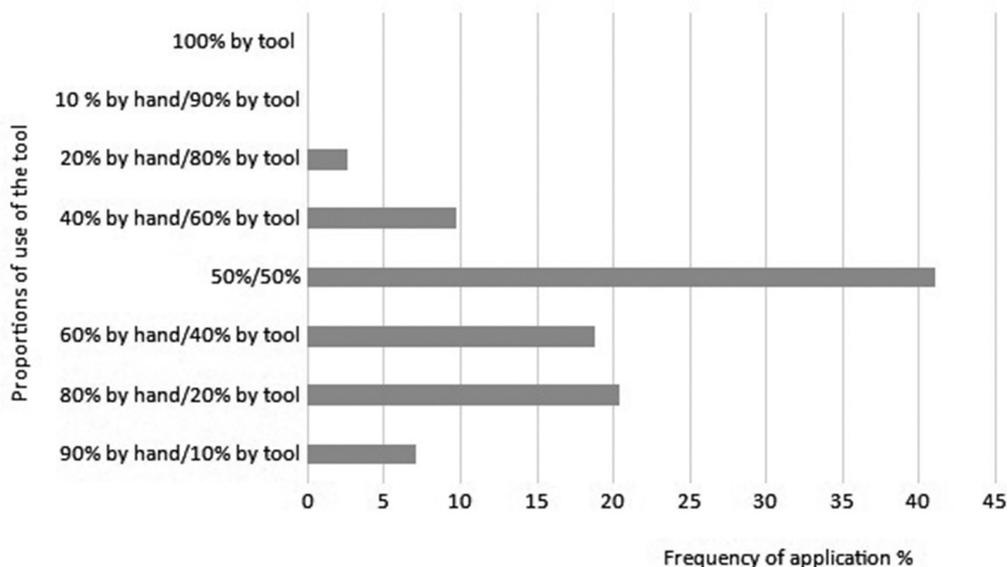


Fig. 6. Percentage frequency of use of the M-Stick tool in the study group during the 10-day rehabilitation process

deep pain responses before and after therapy. According to the complete analysis, better efficacy in reducing pain is achieved among younger people. With age, this ratio decreases (Fig. 8). Patients with their complaints were usually seen by a therapist no later than nine months after the first symptoms of illness appeared, which is most likely due to both ignoring health problems, attempts at self-treatment and the length of waiting lines for inpatient rehabilitation.

In the final interview, the overwhelming majority of the study group's patients (91%) described M-Stick therapy as comfortable and not significantly different from the stages

of therapy during which the therapist worked out tissues without a tool. Overwhelmingly, the patients surveyed expressed their willingness to continue therapy according to the established regimen and denied that tool therapy would leave much tissue trauma in the form of bruising and other pathological subcutaneous phenomena.

DISCUSSION

The research evaluating the validity of M-Stick in Soft Tissue Therapy for lumbosacral spine disorders is of great value for assessing the global effectiveness of the tool therapy. The treatment effects are partially consistent with other

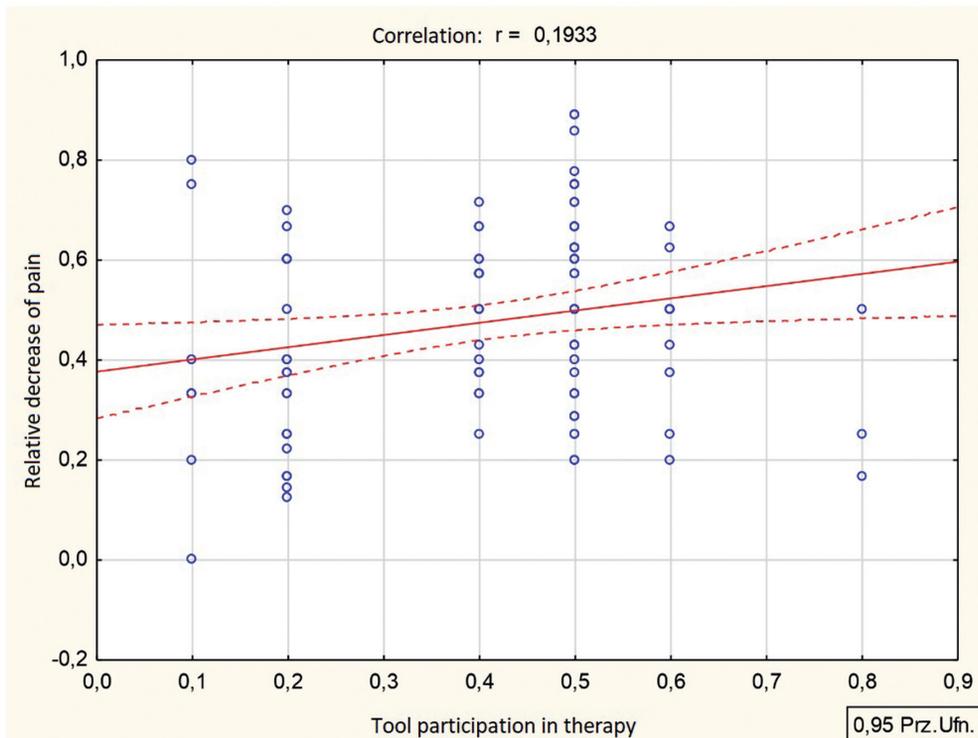


Fig. 7. The effect of tool participation in therapy on the relative decrease in pain in the study group

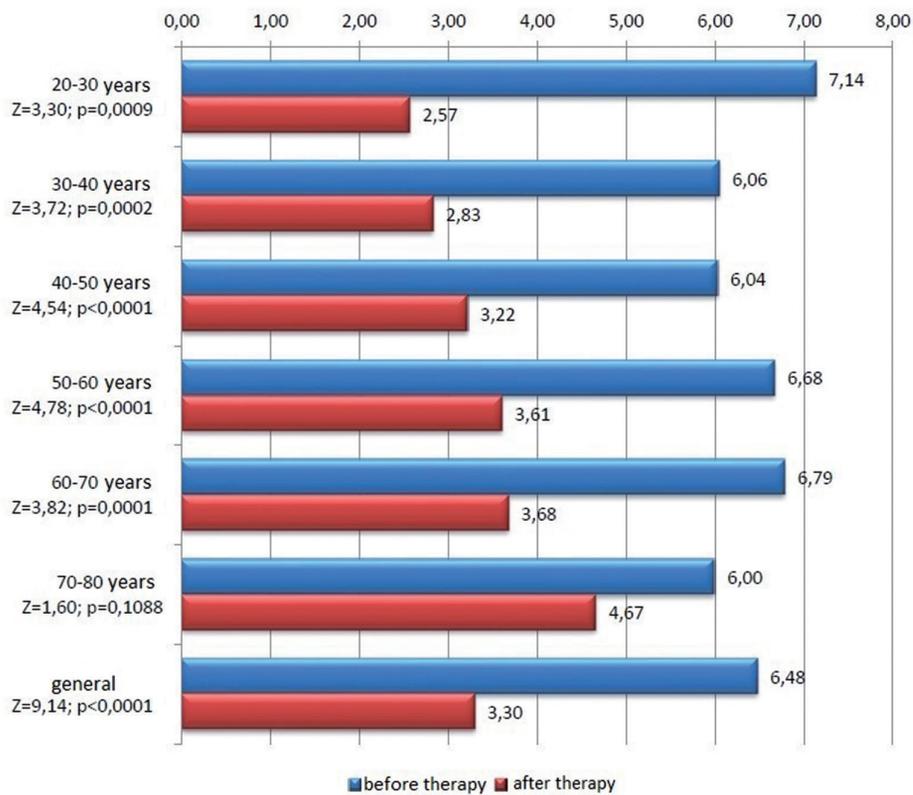


Fig. 8. Change in VAS pain level after the therapy versus the age of patients

studies evaluating therapy with patients with sacroiliac pain, which additionally recommend treatment targeting adjacent or distant soft structures. These studies confirm specific fascial connections and show efficacy in reducing pain in similar treatment algorithms [17]. Such techniques associated with active exercises produce much better results than procedures limited to exercises and manual massage only, as demonstrated by analogous treatment algorithms for patients with cervical spine pain [18].

Due to the waiting period for rehabilitation reimbursed from the Ministry of Health, the above study did not include patients in acute conditions, but its effectiveness in chronic cases is partially supported by other work, that confirms a reduction in fibular adhesion, optimisation of fascial gliding and assistance with symptom relief in both acute and chronic conditions [19], as well as the effects of releasing the area of impaired fascial gliding mobility and improving pain perception over a short period of time [20], which in this case included 10 treatment units. As the study involved analysis of prototype tool therapy, the comparison was made only with thumb work techniques. However, there are other schools of tool therapy like IASTM, questionable in scientific treatises. According to some sets of studies, the effectiveness of tool therapy in the context of the indicators studied is questioned [21]. However, it should be noted here that the tools evaluated in the above studies are significantly different in design from the tool presented. In addition, the results presented were often subject to a high risk of bias and were assessed as very low-quality evidence. As a result, one sees discrepancies in the conclusions regarding tissue accommodation and tolerance to pain stimuli after the therapy, which as the results of the present study showed are reduced, while meta-analyses of identical studies show that myofascial release short-term, significantly improves patients' pain levels and physical performance, but has no significant effect on balance function, pain pressure threshold, trunk mobility, mental health and quality of life [22]. These differences may also be due to the evaluation of similar treatment techniques, although differing in the methodology of implementation.

There have been a number of studies on soft tissue therapy in recent years, but the test products did not appear to generate a profound difference in treatment effects, indicating the need for a more direct comparison [23].

In addition, summaries of a large proportion of studies confirm reductions in soft tissue damage and improvements in peripheral joint ranges of motion during the treatment, but most of these studies address the mechanisms of fascial therapy in animal treatment. Therefore, in order to broaden the scientific basis to a greater extent, similar analyses should be performed in a human clinical settings [24]. Such findings also prompt further evaluation of the M-Stick's effectiveness when confronted with other tools on the market.

CONCLUSIONS

The above study demonstrates that in selected clinical cases in the absence of contraindications, fascial therapy using the specialised M-Stick tool can moderately reduce pain and the primary tension of soft tissues, thus improving the patient's well-being and creating conditions for further healthy physical activity, similar to the classical method, which does not include the use of auxiliary tools. If the patient is properly qualified for the tool therapy on the basis of a full history and clinical tests confirming the need for interference with soft structures and the need to improve the condition of musculofascial structures, the therapy should have a partial effect regardless of the level of pain reported on physical examination or the degree of soft tissue tension on initial palpation. At the same time, the treatment method as leaving moderate tissue bruising in almost half of the cases may be questioned as a safe method, but when other rehabilitation treatments fail to produce the desired results, M-Stick therapy is worth considering. Since musculo-fascial treatment techniques using the M-Stick were evaluated only for a 10-day rehabilitation period and compared only with working with the thumb alone, there is no basis for estimating the effectiveness of the therapy over a longer time frame and any comparisons with other functioning tools in rehabilitation are not possible. This indicates a legitimate need for further study of the M-stick and comparison with tools with a similar role in improving soft tissue function.

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The study received ethical approval Bioethics Committee (no. 18/2022) and written consent from patients to participate in the scientific study.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 21.07.2023

ACCEPTED: 28.10.2023

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* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

PECULIARITIES OF REHABILITATION OF PATIENTS WITH CHRONIC CEREBRAL CIRCULATION INSUFFICIENCY DURING THE WAR

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ABSTRACT

Aim: To improve the clinical diagnosis of CCCI and to develop methods of personalized treatment and rehabilitation of patients with CCCI during the war.

Materials and Methods: 38 patients were examined in age range from 49 to 73 years with diagnosis of CCCI and comorbidity, stressed during the war – 16 males i 22 females. Informed participation consent was obtained from all patients. The diagnosis was confirmed by the data of general clinical, neurological examination, neuroimaging techniques, instrumental, laboratory and neuropsychological testing – Mini-Mental State Examination (MMSE), Depression, Anxiety And Stress Scale-21 (DASS-21), Fatigue Assessment Scale (FAS) and Modified Assessment Of Neurological And Neuropsychological Deficit Scale (MANND)

Results: As a result of the examination of 38 patients with a diagnosis of CCCI and comorbidity using such scales as MANND, MMSE, DASS-21, FAS and provided treatment through combination of acetylcholinesterase inhibitors and choline precursors, data were obtained on decreasing severity of neurological symptoms, regression of anxiety and depression indicators, and the most significant regression of stress and fatigue indicators.

Conclusions: Therapeutic regimen should be personalized, taking into account a wide range of complaints, assessment of neurological and neuropsychological deficit, and management of chronic diseases. The appointment of acetylcholinesterase inhibitors in combination with choline precursors as targeted cholinergic insufficiency correction leads to reduction of asthenic syndrome, indicators of stress, depression and anxiety.

KEY WORDS: chronic cerebral circulation insufficiency, comorbidity, stress, modified assessment of neurological and neuropsychological deficit

INTRODUCTION

Chronic cerebral circulation insufficiency (CCCI) – state of reduction in cerebral blood flow below the physiologically required volume, leading to brain dysfunctions, and this state should last for at least 2 months [1]. It is considered as a syndrome that develops as a result of a slowly progressive violation of cerebral blood circulation, which occurs as a result of the gradual accumulation of ischemic and secondary degenerative changes in the brain, which are caused by repeated ischemic episodes due to the development of the atherosclerotic process and arterial hypertension, with the development of progressive neurological, neuropsychological and mental deficit [2].

As a result of the study of patients with arterial hypertension, cerebral atherosclerosis or a combination of these pathologies, it was found that patients with severe atherosclerosis are characterized by a clearer differentiation of clinical syndromes that corresponded to the occlusion in either the vertebral or carotid artery system. Dysregulation in neuropsychological profile and severe cognitive impairment were associated with hypertension or its combination with atherosclerosis [3].

Pathogenetic mechanisms underlying vascular cognitive impairment and dementia remain controversial due to the heterogeneity of vascular causes and the complexity of the neuropathology of the disease. However, one common feature to all of these vascular causes is dysregulation of cerebral blood flow, which universal consequence – chronic cerebral hypoperfusion subsequently leads to insufficient blood supply to the brain tissue, ultimately contributing to the development of vascular cognitive impairment and dementia.

In addition, CCCI can be a pervasive state of long-term stress factor on the central nervous system (CNS) (especially in the elderly). One of the clinical syndromes, the development of which is most closely related to the effects of chronic stress, is cognitive impairment. It is cognitive disorders due to CCCI that are one of the earliest manifestations of stressful effects on the CNS in general, and they are significantly affect the quality of life and social functioning of patients. That is why the possibility of complex correction of CCCI (vasotropic effect) and cognitive impairment caused by it (nootropic effect) is the main task in modern conditions in doctor practice [4].

Obvious preclinical cognitive and vascular disorders can become an additional powerful stressogenic factor. It is at the stage when the accumulation of violations in the activity of organs and systems at the molecular and biochemical levels as a result of the influence of the aging process, stress or a specific pathological factor has not yet manifested itself in the form of one or another disease, but all the prerequisites for this have already been created, at the pre-disease stage, directed pharmacological influence can be particularly effective [4].

The structure is dominated by chronic cerebrovascular diseases (CVDs), the genesis of which is predominantly multifactorial in nature, characterized by systemic damage and comorbidity. The unity of the pathophysiological processes that lead to the development and progression of cardiovascular diseases and CVD is confirmed by their unique risk factors, such as arterial hypertension (AH), atherogenic dyslipidaemia, hyperglycemia and diabetes mellitus (DM), obesity, especially abdominal type, metabolic syndrome, insulin resistance, chronic kidney disease (CKD), as well as the factor of acute and chronic stress. The situation has seriously changed due to the fact that patients with CVD were additionally affected and are suffering during the war. The most common mental health problems they have are post-traumatic stress disorder and depression.

One of the clinical correlates of chronic cerebrovascular damage is a violation of higher cortical functions. The development of neuropsychological disorders is caused by a change in choline-, serotonin-, adrenergic, and glutamatergic activity, which leads to a impairment of cognitive functions, a violation of memory formation [5].

Timely diagnosis of vascular predemental disorders is of great practical importance for ensuring the quality of life and maintaining the working capacity of patients. However, in the initial stages of the development of cognitive disorders, there are often difficulties in their objectification and control over the effectiveness of the treatment. With CVD, cognitive disorders are potentially curable, their development can be prevented, or their progression can be slowed down, and therefore the diagnosis of cognitive disorders in the initial stages of the disease is of particular importance [6].

AIM

The aim of our work was to improve the clinical diagnosis of CCCl and to develop methods of personalized treatment and rehabilitation of patients with CCCl during the war.

MATERIALS AND METHODS

A neurological and neuropsychological examination was carried out according to the data of scientific research fragment – comprehensive scientific and research topic: “Peculiarities of the clinical symptoms and neuropsychological impairment of patients with discirculatory encephalopathy during the war”.

38 patients were examined in age range from 49 to 73 years with diagnosis of CCCl and comorbidity, stressed during the war – 16 males i 22 females. Informed participation consent was obtained from all patients. The clinical form of CVD, the

diagnosis of arterial hypertension, its degree and stage were established in accordance with current recommendations [7]. The diagnosis was confirmed by the data of general clinical, neurological examination, neuroimaging techniques, instrumental, laboratory and neuropsychological testing – Mini-Mental State Examination (MMSE), depression, anxiety and stress scale-21 (DASS-21), fatigue assessment scale (FAS) and modified assessment of neurological and neuropsychological deficit scale (MANND) [8]. This is a modified scale for neurological and neuropsychological deficit assessment, which was developed for patients with CCCl specifically. It takes into account quantitative changes in the neurological status, namely, damage to the pyramidal, sensory, extrapyramidal, coordinating systems, damage to the cranial nerves, and the most common neurological syndromes, such as cephalic, asthenic, and higher cortical function disorders. This scale is a sensitive comprehensive method for assessing the severity of neurological and neuropsychological deficits, in contrast to existing scales for the isolated assessment of focal neurological symptoms (motor deficits, cognitive disorders or disorders of the emotional sphere) [8].

To study the comorbidity background and the relation between the degree of severity of neurological and neuropsychological deficits and the comorbidity background, was chosen CIRS-G scale (Cumulative Illness Rating Scale for Geriatrics) [9].

The modified assessment of neurological and neuropsychological deficits is a comprehensive method, in contrast to existing scales for the isolated assessment of motor deficits, cognitive disorders or disorders of the emotional-volitional sphere, and has a stable positive correlation (0.707 ($p < 0.001$)) between the number of comorbidity assessment scores according to the CIRS-G scale and MANND score [8].

The inclusion criteria were expanded criteria for the diagnosis of discirculatory encephalopathy caused by atherosclerosis and hypertension: 1) complaints (rapid fatigue, inattention, obliviousness, memory loss, especially for current events, reduced mental capacity, poor general well-being, headache, noise in the head, dizziness, emotional instability, disturbed sleep, sudden impairment of vision, coordination, speech, sensitivity, etc.); 2) cerebral blood flow impairment according to ultrasound of the vessels of the head and neck (stenosis (occlusion) or functional disorders of blood circulation (asymmetry of blood flow, changes in the range of cerebrovascular reactivity)); 3) morphological changes in the brain substance according to neuroimaging techniques results (MRI, CT); 4) signs of cardiovascular diseases, lung diseases, etc. (sternum pain (angina), shortness of breath, general weakness, increased fatigue, swelling of the lower extremities, fainting, dizziness, rapid heartbeat, pain or fatigue in the legs while walking (intermittent lameness), skin discoloration, skin ulcers, etc.); 5) laboratory data on blood composition changes (disorders of lipid metabolism, rheological properties of blood).

The diagnosis was established in the presence of at least 3 of the 5 signs listed above and a causal relationship between them.

Exclusion criteria from the study were the presence of concomitant decompensated diseases or acute conditions that could significantly affect the results of the study.

Statistical processing of the results was carried out using a software package STATISTICA v.64 (license № 12334567).

The authors adhere to the standards of the Helsinki Declaration of the World Health Organization association, as well as Interdisciplinary norms and regulations on the use of animals in research, testing and educational programs, which are published by the appropriate committee dealing with animal research at the Academy of Sciences in the city of New York. The submitted manuscripts relate to the work patients and prepared in accordance with ethical standards.

RESULTS

As a result of the examination of 38 patients with a diagnosis of CCCI and comorbidity using the MANND scale, a quantitative characteristic of CCCI severity was established. Patients were divided into 3 groups according to the severity of neurological and neuropsychological deficits based on the total number of MANND scores. Group I included 8 patients with a score of 1-3, which was equal to slight neurological and neuropsychological deficits. The II group consisted of 17 patients with a total score of 4-7, which corresponds to a moderate neurological and neuropsychological deficit. In the III group there were 13 patients with a severe deficit with a score >7 according to MANND.

Complex therapy of CCCI includes a strategy for the prevention of CCCI and its complications, and an important place is reduction of regulated risk factors for its development, which primarily include hypertension and atherogenic dyslipidaemia. Correction of arterial hypertension was carried out according to general rules, taking into account age and concomitant diseases. The goal of hypotensive therapy is to reduce blood pressure in all patients under the age of 65 to normal, i.e. below 140/90 mm Hg. or to as close as possible to this value, to a well-tolerated level [7]. The principle of treatment of atherogenic dyslipidaemia is a differentiated therapy based on the results of a throughout study aimed at clarifying the causes of its development – hereditary or secondary (caused by diabetes, hypothyroidism, dysproteinaemia, nephrotic syndrome, etc.). The possibilities of non-drug therapy, including diet therapy, physical activity, and weight control, must be used. If these measures are ineffective, medical correction with statins is added within three months.

The spectrum of vascular and neuroprotective drugs (mandatory components of CCCI therapy) is wide, but there is still no single way of their appointment. Taking into account the peculiarities of the pathogenesis of CCCI, the main directions of drug therapy are: improving cerebral blood circulation and hemorheology, increasing of the brain cells resistance to ischemia and hypoxia, antioxidant protection of the brain, and reducing excitotoxicity.

A promising direction of metabolic protection of the brain from ischemia is a direct effect on the neurotransmitter

system of the brain, normalizing the ratio of excitatory and inhibitory neurotransmission activity [10]. Cholinergic networks, which are the connecting link between other neuronal associations and the main reservoir for the development of adaptive neuroplasticity, are most affected by brain ischemia. In this regard, the use of cholinergic drugs is one of the important strategic directions in the combined therapy of CCCI [10]. In our work, we used two groups of drugs aimed at cholinergic insufficiency correction: acetylcholinesterase inhibitors in combination with the choline precursors (neurocytin).

EVALUATION OF THE EFFECTIVENESS OF THE TREATMENT OF PATIENTS WITH CCCI

Statistical processing of the obtained data showed that after treatment, the severity of neurological symptoms due to MANND scale was decreased from 6.1 (4-8) to 4.1 (3-5) ($p<0.01$). Moderately decreased depression and anxiety scores from 4.9 (0-14) to 3.8 (0-5) ($p<0.01$) and from 7.4 (3-11) to 5, 5 (2-8) ($p<0.01$) due to DASS-21 scale. A more significant regression was observed on the stress scale – from 11.5 (7-15) to 8.7 (2-12) ($p<0.01$). The difference of fatigue from 27.8 (25-35) to 19.9 (18-21) was especially noticeable ($p<0.01$). There were no significant changes in the cognitive sphere due to MMSE scale ($p=0.845$) (Table 1).

On the 30th day after treatment, quantitative changes were determined in the groups of patients according to the degree of severity of CCCI due to repeated score of MANND scale: I group (1-3 points – slight neurological and neuropsychological deficit) – 15 patients; II group (4-7 points – moderate neurological and neuropsychological deficit) – 12 patients; III group (>7 points – severe neurological and neuropsychological deficit) – 11 patients.

The obtained results regarding the change in severity of neurological symptoms according to MANND are explained by a decrease in general complaints of anxiety, headache, dizziness and general weakness.

It should be noted that the MMSE score did not change significantly. Such data indicate that a longer-term, individualized and comprehensive approach taking into account the comorbid background is necessary to mitigate cognitive impairment.

The most noticeable changes in the emotional-volitional sphere, according to the DASS-21 scale, were positive results in the stress block, as well as a statistically significant decrease in the depression and anxiety score, although it is less significant, which is primarily due to the fact that the expressed organic depressive disorders were exclusion criteria when selecting patients to participate in the study. Nevertheless, among patients with slight and moderate disorders of the emotional-volitional sphere, a combination of drugs aimed at overcoming cholinergic insufficiency can be effectively used.

DISCUSSIONS

On the 30th day after treatment, quantitative changes were determined in the groups of patients according to the degree of severity of CCCI due to repeated score of MANND scale: I group (1-3 points – slight neurological and

Table 1. Evaluation of the effectiveness of the combined therapy of patients with CCCI and comorbidity

Parameter	1st day Me (±95%)	10th day Me (±95%)	30th day Me (±95%)	Criteria*
MANND	6,1 (4-8)	5,85 (4-7)	4,1 (3-5)	p<0,01
MMSE	26,7 (26-28)	26,8 (26-28)	27,3 (27-28)	p=0,845
DASS-21	22,9 (11-32)	20,8 (10-28)	16,6 (8-19)	p<0,01
Depression	4,9 (0-14)	4,3 (0-11)	3,8 (0-5)	p<0,01
Anxiety	7,4 (3-11)	6,8 (3-10)	5,5 (2-8)	p<0,01
Stress	11,5 (7-15)	9,9 (6-14)	8,7 (5-12)	p<0,01
FAS	27,8 (25-35)	26,1 (22-29)	19,9 (18-21)	p<0,01

Note: * – Friedman test

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Comorbidity is an important risk factor for the development of chronic cerebral ischemia (chronic insufficiency of cerebral circulation). When choosing a treatment scheme, a personalized approach to patients is important, taking into account both a wide range of complaints and the correction of treatment of chronic diseases. The use of targeted drug correction of cholinergic insufficiency leads to a decrease in asthenic syndrome, indicators of stress, depression and anxiety, and the severity of neurological symptoms according to MANND [10].

CONCLUSIONS

Comorbidity and stress are important risk factors for both the development of CCCI and augmentation of the neurological and neuropsychological deficit in patients with CCCI.

Therapeutic regimen should be personalized, taking into account a wide range of complaints, assessment of neurological and neuropsychological deficit, and management of chronic diseases.

The appointment of acetylcholinesterase inhibitors in combination with choline precursors as targeted cholinergic insufficiency correction leads to reduction of asthenic syndrome, indicators of stress, depression and anxiety, and, as a result to reduction of cognitive impairment.

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The article was performed as part of the research work: "Peculiarities of the clinical symptoms and neuropsychological impairment of patients with discirculatory encephalopathy during the war" (state registration number 0114U002119).

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 07.07.2023

ACCEPTED: 10.11.2023

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DETERMINATION OF THE DEGREE OF MANIFESTATION OF INVERSION OF SEXUAL DIMORPHISM OF FEMALE ATHLETES OF PAIR AND GROUP TYPES OF ACROBATICS

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ABSTRACT

Aim: The article is devoted to the study and determination of the degree of manifestation of the inversion of sexual dimorphism according to the masculinity index and J.Tanner's method in female acrobats (sub-elite and elite athletes) and non-athletes.

Materials and Methods: athletes specializing in pair and group sports acrobatics (n=74). Acrobatic girls were divided into 2 groups taking into account the functional duties (roles) in the group and the pair (X±SD): 1) the roles above (on top) (n=32), puberty age (13.96±1.02), 2) roles in the middle and below (n=42), youth age (19.36±2.86). Sports qualifications of female athletes: sub-elite and elite athletes.

Results: The average values (X±SD) of the masculinity index in female acrobats of the top (above) roles are 1.45±0.003, in those in the middle and below – 1.34±0.08, and in non-sports persons – 1, 30±0.04. Somatotyping according to J.Tanner in acrobats of both roles revealed changes in sexual constitution. In acrobats aged 12-15 years (n=32): mesomorphic somatotype was found in 31.25% of female athletes (77.28±3.21), gynecomorphic in 68.75% (95.55±0.41) at p<0.05. In female acrobats of roles in the middle and below (age 16-23 years, n=42), mesomorphic somatotype was found in 80.95% of cases (61.64±2.17), andromorphic in 19.05% of female athletes (98, 21±0.55) at p<0.05.

Conclusions: In female acrobat roles in the middle and below are dominated by athletes with mesomorphic somatotype and with a significant percentage of andromorphic somatotype. Female athletes in the roles above (of the top roles) have preserved the female (gynomorphic) somatotype according to J.Tanner's methodology.

KEY WORDS: sexual dimorphism, female acrobats, role, masculinity, sexual somatotypes

INTRODUCTION

For many years, the study of issues of sexual dimorphism of athletes, including the masculinization of female athletes, continues to be studied and relevant.

At the current stage, sport requires large loads with a high degree of intensity from those who engage in it at various stages of the multi-year process [1].

This especially applies to female athletes, in the training process of which a large volume of physical and psycho-emotional loads without proper compensatory mechanisms and high-quality medical control can lead to serious adaptive changes in the body [2-4].

A number of Ukrainian scientists are fruitfully working at the present time, obtaining new data related to the study of sexual dimorphism from various directions, for example: psychophysiological indicators in highly qualified athletes,

judokas, in sports acrobatics, karate, sports walking, classical powerlifting, etc. [5-9]. The work of Mykhalchenko [10] paid attention to the researches related to the peculiarities of sexual dimorphism and gender identification of the personality type of female athletes in team sports.

Signs of sexual dimorphism in various sports were studied by Tsap at all, 2019 based on the results of a survey of girls aged 17-23 [11]. A number of specialists studied sexual dimorphism among foreign publications [12-14].

In the available scientific and methodological literature, the Internet, and bibliographic databases (Google Scholar, PubMed, Index Copernicus), we did not find any works related to the study of the peculiarities of sexual dimorphism in female acrobats in pair and group acrobatics taking into account different roles. The data obtained by a number of specialists, based on the example of other sports, are

definitely important and can serve as a basis for a broader study of the problem on athletes specializing in acrobatics. But the specifics of this sport, for example, the specifics of selection, certain morpho-functional features of athletes, indices of sexual dimorphism, etc., must be taken into account.

We believe that an in-depth study of the changes that occur in the body of acrobat athletes, their adaptive changes under the influence of intense training, competitive and psycho-emotional loads, continues to be relevant and important for the theory and practice of sports training. 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 the inversion of sexual dimorphism according to the index of masculinity and the index of sexual dimorphism in female acrobats of different roles, ages, and people who do not play sports.

MATERIALS AND METHODS

PARTICIPANTS

Athletes specializing in pair and group sports acrobatics ($n=74$), as well as persons of the same age and in the same number who do not play sports, took part in the research. Female acrobatics were divided into 2 groups taking into account the functional duties (roles) in the group and pair ($X \pm SD$): 1) the roles above (of the top roles) ($n=32$), puberty age (13.96 ± 1.02), 2) roles in the middle and below ($n=42$), youth age (19.36 ± 2.86). Sports qualifications of female athletes: sub-elite and elite athletes.

A part of research was taken by female acrobats, representatives of children's and youth sports schools and clubs in the Dnipro city, Kryvyi Rih, Kamianske, Pokrov (Ukraine).

Informed consent was obtained from all participants to participate in this experiment. Written informed consent was obtained from the children's parents.

Athletes of the same age, anthropometric criteria and indicators of general physical fitness were selected for the group of those who were studied. No statistically significant probable differences were found among these subjects ($p > 0.05$).

The group of non-athletes included female students of higher education institutions in Dnipro city, who had no statistically significant differences in age and anthropometric indicators ($p > 0.05$).

METHODS

System-functional analysis of special literature and Internet resources. Method of anthropometry. Index methods (masculinity index based on shoulder and pelvis width studies, sexual dimorphism index). Methods of mathematical statistics.

PROCEDURE

Anthropometric measurements were carried out according to the methodical recommendations of E.H. Martirosova. The equipment used in the research is: Martin's

anthropometer, medical electronic scales (accuracy up to 10 grams), centimeter tape, vernier caliper. Based on the obtained data of anthropometric studies, indices were calculated.

The determination of the masculinity index, which is an indicator of the degree of masculinization of the body, was studied by the ratio of the width of the shoulders to the width of the hip.

The type of sexual constitution was determined according to the Tanner index (the difference between the triple value of the width of the shoulders and the width of the hip). In the case of an index value below 73.1, the type of sexual dimorphism was diagnosed as gynecomorphic. The mesomorphic type corresponds to index values of 73.1-82.1. Andromorphic type of sexual constitution is diagnosed in the case of index values higher than 82.1 [13].

STATISTICAL ANALYSIS

Statistical processing was performed 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), Brave-Pearson correlation analysis (r). The non-parametric U-Mann-Whitney statistical test was used to examine the differences between the indicators used. The level of significance was taken as $p < 0.05$.

RESULTS

To assess the correspondence of genotypic sex to its phenotypic manifestations, we used specially developed indices of sexual dimorphism, namely: masculinity index and D. Tanner's index.

The average values ($X \pm SD$) of the masculinity index in female acrobats of the top roles are 1.45 ± 0.003 , in those in the middle and below – 1.34 ± 0.08 , and in non-sports persons – $1, 30 \pm 0.04$. Significant ($p < 0.05$) changes in the indicators of female acrobats of those above, relative to the control group (those who do not play sports), were revealed.

According to the data of somatotyping due to J. Tanner (Fig. 1), the following data were obtained in female acrobats aged 12-15 years of age ($n=32$): mesomorphic somatotype was found in 31.25% of female athletes, gynecomorphic in 68.75%. Andromorphic somatotype was not detected in any of the female athletes.

In female acrobats of roles in the middle and below (age 16-23 years, $n=42$), mesomorphic somatotype was found in 80.95% of cases, andromorphic – in 19.05% of female athletes (Fig. 2).

According to the received data of the conducted studies, it was found that the female acrobats of the roles above have less pronounced changes in sexual dimorphism compared to the acrobats of the roles in the middle and below (Table 1).

Gynomorphic (feminine) in those in the middle and below, none of the athletes of this role was found, as opposed to mesomorphic (which is considered transitional) and inversion andromorphic somatotypes. According to the

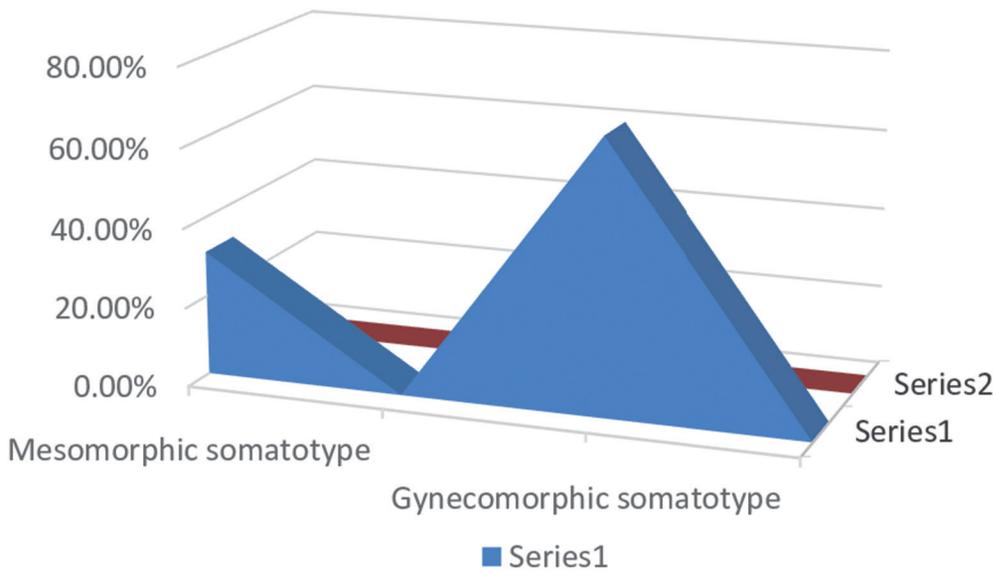


Fig. 1. Somatotyping according to J. Tanner in female acrobats of the above (of the top) roles, % (n=32)

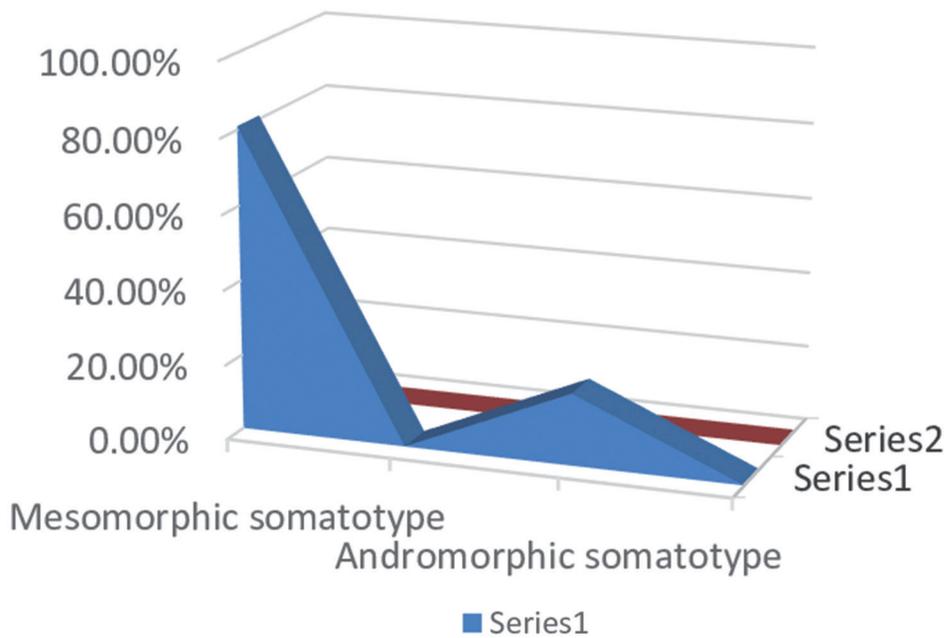


Fig. 2. Somatotyping according to J. Tanner in acrobats of the roles in the middle and below, % (n=42)

data of the non-parametric U-Mann-Whitney statistical test, significant differences were found between the studied indicators of different somatypes both in female acrobats of one role and in comparison with another (the level of significance was taken as $p < 0.05$).

The conducted correlation analysis between the studied indicators of sexual dimorphism in the female acrobats of the role above revealed the following statistically reliable relationships of medium and high degree: between the mesomorphic somatotype indicator according to the Tanner index and the masculinity index ($r = 0.918$), shoulder width

($r = 0.725$), the width of the hip ($r = 0.551$). Between the gynecomorphic somatotype indicator, reliable correlations of medium degree with the width of the hip ($r = 0.357$), shoulder width ($r = 0.727$) were found.

Among the female acrobats in the roles below, statistically significant correlations were found between the mesomorphic type indicator and the Tanner index, masculinity index ($r = -0.492$), shoulder width ($r = -0.515$), hip width ($r = 0.608$). Significant relationships were found between the andromorphic somatotype indicator and shoulder width ($r = 0.728$), masculinity index ($r = 0.477$).

Table 1. Indicators of the index of sexual dimorphism according to J. Tanner of female acrobats of various roles

Statistical indicators	Female acrobats are those above 12-15 years old (n=32)			Acrobats are those in the middle and below, 16-23 years old (n=42)		
	Somatotypes					
	Mesomorphic (n=10)	Andromorphic (0)	Gynecomorphic (n=22)	Mesomorphic (n=34)	Andromorphic (n=8)	Gynecomorphic (n=0)
	31,25 %	–	68,75 %	80,95 %	19,05 %	–
	1	2	3	4	5	6
x±m	77,28±3,21	–	95,55±0,41	61,64±2,17	98,21±0,55	–
SD	0,96	–	1,70	6,15	2,96	–
Min	73,12	–	93,12	52,63	93,65	–
Max	82,11	–	98,15	68,18	103,22	–

$$p_{1,3} < 0,05; p_{1,5} < 0,05; p_{3,4} < 0,05; p_{4,5} < 0,05$$

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. This especially applies to female athletes, who in the training process have a large amount of physical and psycho-emotional loads without proper compensatory mechanisms and poor medical control can lead to the serious adaptive changes in the body [15, 16]. This applies not only to sports of higher achievements, but also to female athletes of different age groups.

In such type of sport as acrobatics, there are a number of important points. The specificity of pair-group acrobatics is that there are different roles of athletes – different in age and morpho-functional features. In the prepubescent and pubertal periods, and then in adolescence, intense physical and psycho-emotional stress in the training and competitive activities of female athletes can lead to anatomical, morphological and functional disorders in the hip bones. These factors can negatively affect the functions occurring in the hip organs of female athletes [17, 18].

Pair-group types of sports acrobatics, which include a large number of strength and tempo exercises, and the training process includes high-volume and intensive loads, also to some extent affect the formation of the female pelvic bone. This especially applies to girls, roles in the middle and below. Their functional duties include a large number of supports and throws, and the loads in terms of strength and duration are not always adequate.

In our work, we considered the study of the processes of adaptive changes of sexual somatotypes, based on the values of the sexual dimorphism index according to J. Tanner and U. Marshall in female athletes of puberty (13-15 years) and youth (16-23 years).

The conducted studies showed the presence of a high percentage of mesomorphic somatotype in female acrobats,

which indicates mild gender dysplasia. It also indicates the intensity of somatic changes in them directed towards androgenization of their body. This can be associated with significant physical and high-intensity exercise.

Andromorphic and mesomorphic somatotypes are considered in women as an inversion of sexual dimorphism, i.e. a pathological shift of somatotypes opposite to the female (gynecomorphic). High values of indicators of the mesomorphic sexual somatotype are considered as markers of somatic adaptive processes occurring in female acrobats. A higher and significant percentage of gynecomorphs was found in the acrobats of the roles above. This means that the physiological female sex somatotype is preserved in this contingent. That is, less pronounced changes in sexual dimorphism, manifested in the formation of a mesomorphic type of body structure (this is a mild dysplasia of the sex) [3, 13].

The detection of a significant percentage of female acrobats with an increase in the size of the width of the shoulders above the size of the hip indicates the degree of displacement of sexual somatotypes in the direction of andromorphism and mesomorphism. The same is observed in the presence of a degree of pelvic narrowing. This may indicate the existing anatomical and morphological changes of female athletes associated with intense physical exercise.

Scientists draw attention to the fact that the most successful female athletes turn out to be the percentage of those who have signs of gender inversion, namely, with morphological manifestations of masculinization of the body. That is, masculinity, as a feature of the physique, in female athletes can indicate their high sports potential [19]. In female acrobatics, in the process of formation of pairs and groups, during the selection, attention is paid to the girls with such a strong physique that they are promising in the further work of pairs and groups [20].

Our research revealed a percentage of female acrobats with increased shoulder width compared to hip width. A number of authors believe that the main cause of dysplasia of the signs of sexual dimorphism in female athletes is significant regular physical exercise, activating the cortex of the adrenal glands with an increase in the release of androgens. Other scientists provide such explanations that a decrease in the level of estrogens below the reference values of the norm can lead to a tendency in the formation of a masculine body type in female athletes [21].

All of this, from the point of view of scientists, is an extremely undesirable phenomenon, because it is a prognostically unfavorable indicator in the somatic reconstruction of the body of female acrobats according to the masculine type, that is, male, with the corresponding hormonal processes. As experts emphasize, the body of female athletes who are young and who started intensive sports before the appearance of menarche is the most prone to psychological influences and morphological changes [22].

Conducted research according to the Tanner index revealed changes in sexual constitution in acrobats of both roles according to andromorphic and mesomorphic body types. When assembling acrobatic pairs and groups, coaches pay attention and focus, first of all, on female athletes in the roles above and below. These are acrobats with manifestations of strength qualities, endurance, explosive power, speed of reaction, and other physical and psychological qualities that are classified as masculine. When sports are started early, namely before the onset of menarche and the establishment of menstrual function, a significant percentage of girls in puberty and adolescence develop non-feminine somatotypes (mesomorphic and andromorphic) [3]. Adaptation of the body of female acrobats to training and competition loads, reduction of fat mass, restructuring of the endocrine system, changes in metabolism, etc., can lead to the formation of new sexual somatotypes for female athletes.

Correlation analysis between different indicators of sexual dimorphism of female acrobats of both roles above showed a significant number of statistically significant ($p < 0.05$) correlation relationships of medium and high degree. Among the sportsmen's, the roles below, a greater number of reliable correlations were found in the girls. This confirms the relatedness of the studied indicators, namely: indices of masculinity and somatotyping according to J. Tanner.

We have developed recommendations for slowing down, and first of all, prevention of undesirable phenomena of atypical sexual somatotype for female athletes, for all

stages of multi-year improvement, with an emphasis on prepubertal and pubertal periods:

1. high-quality and regular medical diagnosis of pre-pathological forms of morpho-functional deviations in female athletes (anthropometric and functional studies) with the possibility of timely correction of adverse phenomena;
2. regular control and compliance of the content of training and competitive loads with the morpho-functional features of the female body;
3. development and introduction into the training and competition process of differentiated individual programs for intensification of loads from the standpoint of adaptive and morphofunctional differences of the female and male body;
4. control over the quality of implementation of modern medical and biological programs for the recovery of athletes.

CONCLUSIONS

1. Research using individual markers of masculinization in acrobats indicates the fact that intensive long-term training sessions lead to adaptive somatic changes in the body of female athletes towards mesomorphic, and even andromorphic, which is the opposite of the female sexual somatotype.
2. The acrobat roles in the middle and below are dominated by athletes with a mesomorphic somatotype and a significant percentage of andromorphic somatotype.
3. Female athletes with the roles above (on top) have retained a female (gynomorphic) somatotype according to J. Tanner's methodology.
4. Studies of cross-sectional and longitudinal dimensions of female athletes in the middle and below (bottom) roles revealed an increase in shoulder width and a decrease in hip width, which led to an increase in the masculinity index.
5. Correlation analysis between different indicators of sexual dimorphism of acrobats of different roles showed a significant number of statistically significant ($p < 0.05$) correlation relationships (from $r = 0.357$ to $r = 0.918$), which confirms the relationship and affinity of some indicators sexual dimorphism with contiguous.

PROSPECTS FOR FURTHER RESEARCH

Further research is planned in the direction of studying the features of sexual dimorphism based on the data of gender identification of the individual and the finger index of acrobats of both sexes and different roles.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 05.07.2023**ACCEPTED:** 02.10.2023

* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

REHABILITATION OF PATIENTS WITH THE CONSEQUENCES OF ISCHEMIC STROKE VIA THE MEANS OF EXERCISES OF PHYSICAL THERAPY

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ABSTRACT

Aim: The aim is to elaborate a physical therapy program for patients affected by ischemic stroke and prove its usability.

Materials and Methods: Comparative analysis of motor activity indicators obtained by diagnosing and monitoring the functional state of ischemic stroke patients using clinical tools. The participants of the experiment are male patients aged between 50-71 years affected by an ischemic stroke.

Results: Elaborated on ischemic stroke physical therapy constitutes the set of therapeutic programs for the period of rehabilitation of patients affected by ischemic stroke, which is realized gradually and consists of 3 components: therapeutic exercises, electric stimulation of one's shoulders and psychological assistance. As a result of the application of the authorial physical therapy program for patients affected by ischemic stroke, there is the occurrence of positive changes in the functional and psychological state of the patients. Experimental data was verified by the comparison of the level of motional activity of the patient before the implementation of a physical therapy program for the patients affected by ischemic stroke, as well as after scientific research.

Conclusions: The usability of physical therapy programs for patients affected by ischemic stroke is statistically proven with the positive shifting of the functional state of the patients.

KEY WORDS: ischemic stroke, physical therapy, therapeutic exercises, multidisciplinary team

INTRODUCTION

Analysis of statistical data by the World Health Organization indicates that for every 100,000 people in developed countries, there is the occurrence of strokes from 100 to 300 cases. The data collected by the Public Health Center of the Ukrainian Ministry of Health illustrates the share of cerebrovascular diseases as the cause of lethal cases among the population of Ukraine, which is 14 percent. Approximately 100,000 strokes occur annually, in the course of the first month after experiencing a stroke approximately 30 percent of patients die and half of them die after 1 year of experiencing a stroke. Merely 10 percent of the patients completely recover, whereas the remaining ones become handicapped [1].

The issue of the physical therapy of patients affected by stroke along with motional dysfunction was researched in scientific works by domestic and foreign scientists [2-11]. The overview of scientific works indicates that comprehensive treatment of individuals affected by ischemic stroke provides for compulsory rehabilitation with the usage of various technologies, methods and physical therapy programs based on scientifically justified and clinically proved

approaches towards physical therapy, ergo therapy by multidisciplinary teams [12-16].

AIM

The aim is to elaborate a physical therapy program for patients affected by ischemic stroke and prove its usability.

MATERIALS AND METHODS

Scientific research was implemented for 5 months (from 02.15.2023 to 07.16.2023) on the basis of "3rd Municipal Clinical Hospital of Poltava Municipal Council". Experimental research provided for comparative analysis of the indications of motional activity, acquired via diagnostics and monitoring of the functional state of the patients affected by ischemic stroke via clinical tools. The participants of the experiment are male patients aged between 50-71 years affected by an ischemic stroke. The research was executed with consideration of the regulations of the Helsinki Declaration.

METHODOLOGY

Diagnostics of the functional state of the patients affected by ischemic stroke before and after the application of the

set of therapeutic exercises was executed via the set of basic categories of the international classification of functioning [5] for comprehensive stroke which included the following tests and scales: Lovett, Bartel, Berg balance Test, The Montreal Cognitive Assessment, "The Timed Up and Go" Test, as well as Trunk Control Test, monitoring of functional independence, developing classes for elimination of cognitive disorders and logopedic component. Experimental data was verified by the comparison of the level of motional activity of the patient before the implementation of a physical therapy program for the patients affected by ischemic stroke, as well as after scientific research.

RESULTS

Experimental physical therapy program in the case of hemorrhagic stroke within the rehabilitation period was elaborated according to the Directive of the Ministry of Health No. 602 08.03.2012 "Concerning certification and implementation of medically-technological documents for standardization of medical aid in the case of ischemic stroke". The particularity of our authorially elaborated program of physical therapy in cases of ischemic stroke within the rehabilitation period was the focus on the recent relevant version of the Australian clinical directive concerning medical aid for patients affected by stroke [8]. Our authorially elaborated program consists of a gradually divided comprehensive physical therapy course, which, consequently, contains the authorial set of passive and active exercises of medical gymnastics combined with electric stimulation of one's shoulders, psychological aspect (psychological consulting, psychological assistance, development activities for elimination of cognitive disorders), as well as logopedic one (logopedic gymnastics, exercises for the improvement of articulation, Su-Jok massage (via small massaging ball and ring).

According to Article 18 of the Law of Ukraine "On rehabilitation in the sphere of public healthcare" physical

therapy is executed by a multidisciplinary rehabilitation team. This is also a carefully organized and functionally separated team of rehabilitation specialists, united by common objectives and tasks concerning rehabilitation and provide rehabilitation aid of broad and medium extent in stationary and ambulatory institutions in the course of urgent, post-urgent and prolonged periods of rehabilitation. Effective rehabilitation of patients, affected by ischemic stroke provides for the participation of the following sort of specialists in a multidisciplinary team: physiotherapist (rehabilitation therapist), who provides the restoration of motional functions, ergotherapist (providing restoration of household skills), the doctor (providing assistance in the sphere of medical competence), speech therapist (a logopedic specialist for cognitive restoration and swallowing function), psychologist (examining the psychological state of patients and preventing depression) [10, 17].

An experimental physical therapy program in the case of ischemic stroke within the recovery period was elaborated for male patients aged between 50-71 years affected by ischemic stroke. Objective status data is the following: the state of the patient is satisfactory, the integument is clean, peripheral lymph nodes are not palpable, the lungs are not hoarse, heartbeat is rhythmic, pulse indication is 60-69, rhythmic, blood pressure indication is 140-146/95-105 mm Hg, body temperature is within the range of 36.6 to 36.8 degrees, the abdomen is soft and painless, oedema is absent, defecation and urination are wieldable. The examined period is a post-treatment period with a motor mode of a gentle recovery sort. Our authorially elaborated physical therapy program for patients affected by ischemic stroke constitutes a set of therapeutic exercises, which realized gradually and consist of the following components: therapeutic exercises, electric stimulation of one's shoulders and psychological assistance.

A brief overview of our authorially elaborated program is presented in Table 1.

Table 1. Individual physical therapy program in cases of hemorrhagic stroke in the course of rehabilitation period

Starting position	Exercise description	Number of movements	Methodical recommendations
Preparatory part. Passive joint movements			
1.	Lying on the back	<u>Shoulder joint:</u> bending, distancing, approaching, rotation (outward, inward), extending	The rhythm is slow
	Lying on the functioning side	10-12 times 10-12 times 10-12 times 10-12 times	
2.	Lying on the back	<u>Elbow joint:</u> bending extending pronation supination	The rhythm is slow
		10-12 times 10-12 times 10-12 times 10-12 times	
3.	Lying on the back	<u>Wrist joint:</u> bending extending	The rhythm is slow
		10-12 pasib 10-12 pasib	

4.	Lying on the back	<u>Upper limb finger phalanges:</u> bending extending distancing approaching	10-12 times 10-12 times 10-12 times 10-12 times	The rhythm is slow
5.	Lying on the back The starting position is lying on the functioning side	<u>Hip joint:</u> bending, distancing, approaching, rotation (outward, inward), extending	10-12 times 10-12 times 10-12 times 10-12 times 10-12 times	The rhythm is slow
6.	Lying on the back	<u>Knee joint:</u> bending extending	10-12 times 10-12 times	The rhythm is slow
7.	Lying on the back	<u>Ankle joint:</u> bending extending	10-12 times 10-12 times	The rhythm is slow
8.	Lying on the back	<u>Inferior limb finger phalanges:</u> bending extending	10-12 times 10-12 times	The rhythm is slow
Main part				
1.	Sitting on the chair, with one's intertwined fingers	Exercise No. 1. The arms must be raised above the head, the wrists must be placed on the nape, afterwards the arms must be slowly lowered on both sides. Repeat for the indicated number of times.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, the physical therapist must provide the physical aid for the execution of the exercise if necessary.
2.	Sitting on the chair, with one's intertwined fingers	Exercise No. 2. Straight arms must be on the level of the shoulders, then turned on both sides at 0 degrees. Afterwards, they must be rotated outward and inward with them returning to the starting position. At the end of the exercise, arms must be slowly lowered.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, the physical therapist must provide the physical aid for the execution of the exercise if necessary.
3.	Sitting with one's face aimed at the table, the arms are bent in elbow joints, forearms are laid on the table, the wrist is in the middle position between pronation and supination	Exercise No. 3 Rotation of the forearms inward and outward.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
4.	Sitting with one's face aimed at the table, the arms are bent in elbow joints, forearms laid on the table, the wrist is in the position of supination	Exercise No. 4 Approaching the forearm to the torso, with its sliding on the surface of the table	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
5.	Sitting with one's face aimed at the table, fingers are intertwined in „locked” position on the level of chest	Exercise No. 5 Execution is about turning the palms upward, and drawing it forward. Return to the starting position.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
6.	Sitting with one's face aimed at the table, forearms are laid on the table, hands are laid on the table, palms down	Exercise No. 6 Clenching the fingers into a fist with their later extension. The number of repeats: alternately for each hand.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
7.	Sitting on the chair with one's wrists laid on the lap	Exercise No. 7 Rolling from the heel to phalanges of toes of functioning leg, then such movement must be repeated by the traumatized leg.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.

8.	Sitting on the chair with one's wrists laid on the lap	Exercise No. 8 Pacing on the same place alternately for each leg, with the highest raising of the knees upward.	10-12 times	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
9.	Sitting on the chair with one's wrists laid on the lap	Exercise No. 9 Sliding on the floor by the feet, similarly to the skiing process.	10 times for each leg	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
10.	Sitting on the chair with one's wrists laid on the lap	Exercise No. 10 Functioning leg must be extended in the area of the knee, phalanges of toes must be drawn inward and afterwards, turned to the starting position. Repeat this exercise for the traumatized limb.	10 times for each leg	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
11.	Sitting on the chair with one's wrists laid on the laps, the legs are fixated in the rehabilitation trainer. Required equipment: The rehabilitation trainer for legs OSD-CPS005BC.	Exercise No. 11 Pedalling the rehabilitation trainer forward and backward with two legs at the same time.	20 times for each side	The rhythm is slow. A patient's attention is focused on reaching the objective, physical therapist must provide the physical aid for the execution of the exercise if necessary.
Concluding part				
12.	Functional electric stimulation	For execution of electric stimulation there was the application of PowerDot 2.0. Objective: being applied in the case of the post-stroke shoulder subluxion. Electric stimulation was applied to the deltoid muscle after every class with the patient for 30 minutes.		
13.	Logopedic consulting	<p>Logopedic process provided for patient's acquisition of techniques of execution of logopedic gymnastics and exercises for enhancement of the articulation, as well as Su-Jok exercises with the small massaging ball and the ring.</p> <p>These logopedic exercises must be executed daily:</p> <p>Exercise No. 1: It is necessary to slide with the tongue on the surface of the upper and inferior lip 4-5 times. It must be done clockwise and counter-clockwise. The inferior lip must be drawn on the place of upper lip, as high as possible and stick the muscles of inferior lip in this position for 1-2 seconds. Return to the starting facial expression (the exercise must be repeated for 5-10 times, with the same algorithm applied to the upper lip).</p> <p>Exercise No. 2: Roll the tongue inwards and touch it to the solid part of palate, and later to the soft one. The mouth must be closed, the neck and head must be drawn forward. It's necessary to stick out the tongue from the open mouth to the maximal length and preserve this position for 2-3 seconds. Repeat for 5-10 times.</p> <p>Exercise No. 3: In this exercise it is recommended to casually click with one's tongue in the course of the day. The sound must be akin to clinking of horseshoes.</p> <p>Exercise No. 4: The meaning of the exercises lies in rolling your tongue inward and then trying to stick out your rolled-in tongue from the mouth.</p> <p>Exercise No. 5: In this exercise it is necessary to smile with the closed mouth but the upper lip must demonstrate the range of teeth. Repeat for 5-10 times. Then the smile must be concealed, with the lips being shut and the teeth must be concealed. Repeat for 4-5 times.</p> <p>Exercise No. 6: Patient must stick out the tongue and produce the hissing sounds akin to a snake's hissing.</p> <p>Exercise No. 7: It is necessary to press the lips into a small hole and preserve them in this position for 5 seconds. Repeat for 5-10 times. The lips must be pressed against each other, although there must be the distance between jaws of approximately 2 centimetres. The tongue must be rotated clockwise and counter-clockwise in this space of 2 centimeters.</p> <p>Exercise No. 8: Patient does an "air kiss", the lips must be necessarily unclenched with the loud sound.</p> <p>Exercise No. 9: Patient must stick out the tongue in attempt to touch the nose with it. Repeat for 5-10 times.</p>		
14.	Psychological consulting	<p>The psychological research and restoration of cognitive functions, which certainly are consciousness, attention, orientation, ability of speech, gnosis, visual and spatial perception, praxis, as well as executive functions (judgement, ability to foresee consequences of one's actions, solution of problems, abstract thinking, planning, ability to start actions and realize plans). The psychological consulting and assistance of patients are aimed at the formation of positive rehabilitating and vital sorts of worldview, restoration of the integrated „Ego“ of patients, correction of the process of self-development and self-perception of personality, self-awareness and correction of interpersonal ties, realization and acceptance of the new social role by the personality, formation of new life concepts and acquisition of new techniques for resisting distress.</p> <p>Psychologist's work was also aimed at the correction of valued objectives, acquisition of autogenic training skills such as meditation or art therapy.</p> <p>Psychologist's work is executed twice a week.</p>		

The objective of this treatment set lies in the amplification of blood circulation in the area of big and smaller joints. This helpful way of treatment is applied for the restoration of suspended functions diagnostics of joint contracture and alleviation of their pain. Passive movements must be executed with a slow rhythm with the biggest amplitude possible. Movements must not be accompanied by pain. In the course of execution drastic movements at the moment of extension of spastic muscles are prohibited, since there is a high probability of reflex muscle contraction. Previously mentioned exercises develop motional capabilities, activate vegetative systems, stimulate and normalize the functionality of all systems of the organism, and augment the resistance of the organism against unfavorable environmental factors. Considering the fact that the fundamental meaning in the clinical situation concerning paresis and paralysis after stroke cases is related to motional dysfunction, it leads us to the conclusion that the fundamental task of rehabilitating treatment is the normalization of motional activity of patients. All exercises must be performed slowly with a strong accent on the principle of the correct motional trajectory.

To improve motor functions after the cases of stroke, we also applied functional electric stimulation, whose usage proved itself as the confirmation of the usability of functional electric stimulations in the way of augmentation of muscular capability of patients affected by stroke. For electric stimulation to be possible, there was the application of PowerDot 2.0, whose maximal effectiveness proved itself in the cases of post-stroke shoulder subluxation. Electric stimulation was applied on the deltoid muscle, after each class with the patient for 30 minutes.

After the execution of the rehabilitating measures, we performed a numeral estimation of emerging disorders and restrictions of patients and estimated the impact of environmental factors. Detected functional disorders were formulated in the ICF category. After application of our authorial physical therapy program, several positive shifting were detected about functional and psychophysical state of the patients, which was confirmed by positive tendency of examined indications: rehabilitating diagnosis of the patients was improved, particularly b7301.4 improved to b7301.2; from d550.2 improved to d550.1; from d510.3 improved to d510.2; from d520.3 improved to d520.2; from d540.3 improved to d540.2; from d598.3 improved to d598.2; from d4100.3 improved to d4100.2; from d450.3 improved to d450.2; from d469.4 improved to d469.3; from d330.3 improved to d330.1; from d355.3 improved to d355.3; from d998.3 improved to d998.2.

DISCUSSION

The task of the early period of physical therapy and ergo therapy in the case of ischemic stroke includes prevention and treatment of complications related to immobilization, detection of functional deficit and preserved capabilities of patients, improvement of physical state, improvement of motional and sensory functions, restoration of self-servicing and basic household skills [13, 18].

The fundamental principle in the course of construction of physical therapy programs is the principle of individual approach and, generation of individual objectives for all patients. For augmentation of the effectiveness of physical therapy program ergo therapy and improvement of the rehabilitation process in a way of management in the process of formulation of individual objectives for the patients in the course of undergoing the program of physical therapy, ergo therapy in the case of ischemic stroke, the SMART methodology was also taken into account.

Our elaborated program was created according to actual regulating documentation in the field of public healthcare [16, 17, 19] and Australian clinical guidance, which constitutes a comprehensive physical therapy course, which is executed gradually and contains the authorial set of passive and active exercises of medical gymnastics combined with electric stimulation of one's shoulders, psychological aspect (psychological consulting, psychological assistance, development activities for elimination of cognitive disorders), as well as logopedic one (logopedic gymnastics, exercises for the improvement of articulation, Su-Jok massage (via small massaging ball and ring). Clinical instruments for estimation of the functional state of the patients in the course of execution of the scientific research were domains in the role of ICF-core-set instrument (the set of basic ICF categories) [5] for comprehensive stroke which included the following tests and scales: Lovett, Bartel, Berg balance Test, The Montreal Cognitive Assessment, "The Timed Up and Go" Test, as well as Trunk Control Test, monitoring functional independence.

Our elaborated physical therapy program in the case of ischemic stroke in the course of the recovery period constitutes the authorial set of active and passive exercises of medical gymnastics combined with electric stimulation of one's shoulders, along with psychological and logopedic components.

CONCLUSIONS

After application of our authorial physical therapy program, several positive shifting were detected about functional and psychophysical state of the patients, which was confirmed by positive tendency of examined indications. Being performed, psycho-logopedic work ensured the improvement of cognitive functions of patients in the course of rehabilitation (from moderate to light manifestation of disorders), stabilization of their emotional state, acquisition of stress resistance skills, harmonization of relationship system of the patients towards themselves, micro- and macro social groups and formation of new life concepts.

Thus, our elaborated experimental physical therapy program for people affected by ischemic stroke in the course of the recovery period proved itself as a usable and effective one. The further ways of deepening this research we suggest in the enhancement of physical therapy of individuals affected by ischemic stroke by the means of kinesitherapy.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 10.08.2023

ACCEPTED: 11.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

DYNAMICS OF LAW ENFORCEMENT OFFICERS' PHYSICAL AND MENTAL HEALTH INDICATORS IN THE CONTEXT OF SOCIAL TENSION AND RECOMMENDATIONS FOR THEIR IMPROVEMENT

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ABSTRACT

Aim: To investigate the dynamics of law enforcement officers' physical and mental health indicators in the context of social tension.

Materials and Methods: The research, which involved 74 law enforcement officers (men) aged 25-35, was conducted in 2021-2022. To study the physical health of law enforcement officers, we evaluated such indicators as the Robinson index, the Vital index, the Stange test, the Genchi test, and the Ruffier test. To study mental health, we used such methods as the "Rapid Diagnosis of Psycho-Emotional Stress", and the "Mental Health Continuum – Short Form" (MHCSF-UA).

Results: The research revealed a significant ($p \leq 0.01-0.001$) negative dynamics of law enforcement officers' physical and mental health indicators in the context of social tension (COVID-19 pandemic, war, participation in hostilities). The article reveals a low level of functioning of the cardiovascular and respiratory systems; a high level of professional stress; a low level of satisfaction with life and service; a depressed emotional state. Practical recommendations for the implementation of corrective measures to preserve (restore) the physical and mental health of law enforcement officers have been developed.

Conclusions: It has been determined that law enforcement officers in the context of social tension have a low level of physical health indicators, are under constant stress, and exhibit certain personality changes that affect their psychophysical state, mood, and well-being. All this negatively affects the effectiveness of their professional activities and requires correction.

KEY WORDS: physical health, mental health, law enforcement officers, social tensions

INTRODUCTION

At present, the need to stimulate the staff of police organizations is an important applied issue, which should be accompanied by an increase in their labor efficiency, management of their performance, and preservation of the physical and mental health of specialists within the scope of their professional activities. Carrying out targeted measures to preserve and restore the health of law enforcement officers makes it possible to ensure their effective work and achieve positive results [1, 2]. However, these trends are not always justified in the context of social tension (COVID-19 pandemic, war, participation in hostilities) [3, 4].

It is worth noting that objective realities faced by modern law enforcement officers cause situations that they have not previously encountered in their lives and work, and which impose new psychophysical requirements on them [5-7]. At the same time, the high speed of social change

is difficult to master and overcome, given its dynamism. Thus, the course of professional activities not only inevitably actualizes the personal potential of a modern law enforcement officer, but also sets him/her the task of his/her continuous development and improvement. According to scientists [8], the cardiovascular and respiratory systems of the body suffer the most in uncertain extreme conditions of social tension. Scientists [9, 10] note that the psychophysical overcoming of systematic stress by police officers contributes to their adaptation in the context of performing specific functions (ensuring habituation to critical and emergency situations).

The study of the physical and mental health of law enforcement officers, and the use of technologies for the prevention and correction of their professional destruction is due not only to the direct connection of this process with the effectiveness of law enforcement activities but also to the possibility of the potential impact of negative factors on

the life-sustaining activity of each law enforcement officer [11-13]. At the same time, the physical and mental state of law enforcement officers changes, which leads to possible deterioration of their health, psychophysical problems, and personal changes [14, 15]. All this requires a rethinking of several functional problems of law enforcement officers' health and working capacity, which are manifested in various areas of interaction and life.

AIM

The aim is to investigate the dynamics of law enforcement officers' physical and mental health indicators in the context of social tension. Objectives: 1) to identify and compare indicators of the physical and mental health of law enforcement officers in the context of different conditions of social tension; 2) to develop practical recommendations for the preservation (restoration) of the physical and mental health of law enforcement officers.

MATERIALS AND METHODS

PARTICIPANTS

Diagnostic and correctional work was carried out among Kyiv police officers ($n = 74$), men aged 25-35 years, at the National Academy of Internal Affairs (Kyiv, Ukraine) to determine the dynamics of law enforcement officers' physical and mental health in the context of social tension, during 2021-2022.

METHODS

To achieve the aim of the research, a set of interrelated methods was used: bibliosemantic, comparative, diagnostic, systematic analysis and generalization, and statistical. The bibliosemantic method was used to conduct an analytical review of scientific sources on the outlined issues. 21 sources from the databases Web of Sciences Core Collections, Scopus, PubMed, Index Copernicus and others were investigated.

The comparative method involved analyzing the indicators of the studied law enforcement officers in 2021 (law enforcement activities in the context of peaceful conditions, but taking into account the impact of the COVID-19 pandemic on society) and in 2022 (law enforcement activities in wartime, participation in stabilization measures). The diagnostic method involved studying the dynamics of law enforcement officers' physical and mental health indicators. To study the physical health of law enforcement officers, we evaluated such morphological and functional indicators as the Robinson index, the Vital index, the Stange test, the Genchi test, and the Rufier test [16]. To study mental health, we used such methods as the "Rapid Diagnosis of Psycho-Emotional Stress" [17], and the "Mental Health Continuum – Short Form" (MHCSF-UA) [18].

The Robinson index characterizes the efficiency of a law enforcement officer's cardiovascular system. A decrease in the index indicates an improvement in the functioning of the system. The Robinson index was determined by the ratio of the product of systolic pressure and resting heart rate to 100. The vital index is a criterion for the reserve of external respiratory functions, defined as the ratio of

the vital capacity of the lungs to the body weight of law enforcement officers. Functional tests with breath holding (Stange – during inspiration, Genchi – during expiration) characterize the respiratory function of the law enforcement officer's body. The tests were performed in a sitting position in seconds. The Rufier test allowed us to assess the heart performance and was determined by the rate of heart rate recovery after exercise (30 squats in 45 seconds).

The "Rapid Diagnosis of Psycho-Emotional Stress" method includes 11 questions and allows identifying people with high levels of psycho-emotional stress, which is especially important for law enforcement officers. The method is used primarily to assess a person's mental health using the following scales: psychosocial stress scale; scale of life satisfaction in general; scale of satisfaction with living and working conditions; and scale of satisfaction with basic needs.

The "Mental Health Continuum – Short Form" (MHCSF-UA) questionnaire provides answers to 14 questions about the respondents' well-being over the past month. It allowed us to determine the frequency of experiencing specific states (flourishing, languishing, satisfactory) during this period.

PROCEDURE

The research was conducted in three stages. The first stage involved an analytical review of the literature on the peculiarities of changes in the physical and mental health of law enforcement officers under the influence of specific conditions and the determination of the diagnostic and methodological tools for the research. The second stage provided conditions for carrying out the diagnostic work with the help of the selected tools. The third stage involved processing, systematization and generalization of indicators, as well as logical and semantic interpretation of the data.

STATISTICAL ANALYSIS

The mathematical and statistical method was used to process the experimental data obtained. The compliance of the sample data distribution with the Gauss' law was assessed using the Shapiro-Wilk W test. The reliability of the difference between the indicators was determined using the Student's t -test and Pearson's Chi-square (χ^2) criterion. The reliability of the difference was set at $p < 0.05$. All statistical analyses were performed using SPSS software, version 10.0, adapted for medical and biological research.

Ethical approval. The research was carried out in accordance with the requirements of the Regulations on academic integrity at the National Academy of Internal Affairs. This document was approved by the Academic Council of the National Academy of Internal Affairs (protocol No. 5 of 27.03.2018) and put into effect by order of the rector of the Academy (Order No. 422 of 30.03.2018). Prior consent to participate in the study was obtained from all respondents.

RESULTS

The results of the assessment of the dynamics of law enforcement officers' physical health indicators in the context of social tension are presented in Table 1.

Table 1. Dynamics of law enforcement officers' physical health indicators in the context of social tension (n=74), mean±m

Physical health indicators	Stages of research		Significance of the difference	
	2021	2022	t	p
Robinson index, c.u.	91.6±0.69	95.9±0.77	4.16	≤ .001
Vital index, ml/kg	56.7±0.82	52.3±0.89	3.64	≤ .01
Stange test, s	50.5±1.46	39.7±1.61	4.97	≤ .001
Genchi test, s	34.5±0.77	29.2±0.84	4.65	≤ .001
Rufier test, c.u.	9.7±0.16	10.6±0.18	3.74	≤ .001

Table 2. Indicators for assessing the level of psycho-emotional stress of law enforcement officers (n=74), %

Scales for assessing psycho-emotional stress	Level of manifestation	Stages of research		Significance of the difference	
		2021	2022	χ ²	p
Psychosocial (professional) stress	a	41.9	62.2	8.71	≤ .001
	b	39.2	22.9		
	c	18.9	14.9		
Satisfaction with life in general	a	29.7	13.5	8.09	≤ .001
	b	51.4	59.5		
	c	18.9	27.0		
Satisfaction with living and working conditions	a	32.4	14.9	8.53	≤ .001
	b	46.0	59.4		
	c	21.6	25.7		
Satisfaction with basic needs	a	32.4	14.9	9.70	≤ .001
	b	44.6	48.6		
	c	23.0	36.5		

Legend: a – high level; b – average level; c – low level.

Table 3. Stability of law enforcement officers' mental health (n=74), %

State of law enforcement officers	Stages of research		Significance of the difference	
	2021	2022	χ ²	p
Flourishing	32.4	14.9	9.45	≤ .001
Languishing	21.6	33.8		
Satisfactory (moderate)	46.0	51.3		

It was found that all studied indicators of the physical health of law enforcement officers have a negative trend – there was a significant ($\leq 0.1-.001$) deterioration in the Robinson index during the research period – by 4.3 units; Vital index – by 4.4 ml/kg; Stange test – by 10.8 seconds; Genchi test – by 5.3 seconds; Rufier test – by 0.9 c. u. At the same time, while in 2021 most indicators were at an average or good level for men aged 25-35 years, in 2022 they were below average (Robinson index, Vital index) and low or satisfactory (Stange, Genchi, Rufier tests). These negative changes in law enforcement officers' physical health indicators, which occurred in the context of social tension, are due to a significant decrease in their motor activity (lack of systematic exercise), disruption of diet and sleep, increased levels of neuropsychological tension, and stress, and other negative factors.

The results of the study of law enforcement officers' mental health using the "Rapid Diagnostics of Psycho-Emotional Stress" method are presented in Table 2.

The data obtained show that 62.2 % of modern law enforcement officers have a high level of psychosocial (professional) stress, and 22.9 % have an average level. For comparison, in 2021, 41.9 % of law enforcement officers had a high level of stress, and 39.2 % had an average level. As you can see, the obtained indicators reveal significantly ($p \leq .001$) negative dynamics of this state, which is primarily due to the performance of specific functions in the context of war and hostilities. In addition, this indicates a pronounced need for periodic psychological assistance from qualified professionals. The above indicators are to some extent confirmed by the diagnostics of the level of satisfaction with life. In particular, only 13.5 % of police officers in 2022 demonstrated that they had a high level of satisfaction, compared to 29.7 % in 2021 ($p \leq .001$). The average level of life satisfaction in 2022 did not change dramatically (59.5 % compared to 51.4 % in 2021), but the indicator of low level of life satisfaction among law enforcement officers increased significantly from 18.9 % (2021) to 27.0 % (2022), indicating a significant deterioration in

the situation ($p \leq .001$). The respondents demonstrate similar indicators on the scale of satisfaction with living and working conditions. In particular, there is a significantly negative trend in the indicators of high level of satisfaction with living and working conditions – 32.4 % of law enforcement officers demonstrated this in 2021 and only 14.9 % in 2022. 25.7 % of respondents (2022) are dissatisfied with the development their professional activities. This requires changes in the way and model of functional behavior, as lack of job satisfaction affects the mental health of law enforcement officers.

The research also showed that not all law enforcement officers can satisfy their own needs to function properly, fulfill their self-realization, and perform their social function (in particular, the need for safety and security, stability, and social needs). This can be seen in the negative trend of quantitative indicators among law enforcement officers in the context of social tension. Thus, the indicators of high level of satisfaction with basic needs decreased from 32.4 % in 2021 to 14.9 % in 2022 ($p \leq .001$). At the same time, 36.5 % of law enforcement officers in 2022 demonstrated a low level of need satisfaction (23.0 % in 2021). This indicates that due to social tensions, law enforcement officers are forced to limit themselves in many ways, especially in social contacts, which generally negatively affects their physical and psychological well-being.

Professional stress and job satisfaction can determine the stability of law enforcement officers' mental health. To determine the state of mental health of law enforcement officers, we used the questionnaire referred to as the "Mental Health Continuum – Short Form" (MHCSF-UA); the data are presented in Table 3.

According to the results of the research, only 14.4 % of modern law enforcement officers demonstrate a state of flourishing; 33.8 % – languishing; 51.3 % – a satisfactory (moderate) state. This leaves its mark on their motivation and performance for the service. For comparison, in 2021, the same law enforcement officers had significantly ($p \leq .001$) different indicators of mental health stability, namely: flourishing – 32.4 %; languishing – 21.6 %, satisfactory (moderate) state – 46.0 %. Thus, despite minor differences in the quantitative indicators of law enforcement officers with satisfactory state, there is a significant ($p \leq .001$) negative trend in the state of flourishing among employees. At the same time, the number of people with languishing state has increased. Given this, in the context of social tension, the following indicators should be determined and taken into account during psychodiagnostic work among the personnel of police units: the presence of clear goals in the work and life of a law enforcement officer; the presence of complete plans and hopes for the near future; positive attitude towards oneself; ability to concentrate on specific tasks at work or during training; enjoyment of overcoming obstacles and difficulties; ability to relieve muscle and emotional tension; ability to overcome (control) professional stress; ability to express one's feelings and emotional stress.

DISCUSSION

Social tension usually encompasses the specifics of social relations and professional interaction that leave a certain

imprint on the functionality of the staff of any organization. The level of social tension, its stages, and phases determine individual assessments of the problem situation by the employees themselves [19]. The more specific the nature of the organization's activities, the more such situations affect professionals' physical and mental health.

Law enforcement activities are accompanied by the impact of negative factors on the life and professional activities of each law enforcement officer. The results of our research state the fact that in the context of social tension (pandemic, war, and hostilities), the likelihood of negative dynamics of law enforcement officers' physical and mental health indicators increases, which certainly determines the course of life-sustaining activities. According to scientists [16, 20], in crises of professional activity, a person gradually loses awareness and understanding of himself/herself, his/her life in the world, the fullness of living and experiencing the present moment, a sense of freedom and the ability to make the best choice. The cardiorespiratory system of the body deteriorates significantly. The above is confirmed by our data, which shows that a significant number of modern law enforcement officers are dissatisfied with the process of their professional and life activities. Most of them have significantly deteriorated physical health. This leads to a depressed emotional state, decreased working capacity, and errors in work. In such circumstances, law enforcement officers need to make appropriate changes in the way and model of functional behavior, as lack of job satisfaction can significantly affect the state of mental health of a law enforcement officer.

Professional activity determines the needs of law enforcement officers, ensures the achievement of socially and professionally significant results, and establishes or changes the status of the individual in the team-spirited workforce [1, 5, 21]. At the same time, the specifics of the activity itself can adjust the motivational expectations of law enforcement officers. They are forced to limit themselves in many ways, especially in social contacts, which generally affects their physical and psychological well-being. At a certain stage of professional activity, the actualization and dominance of these needs, on the contrary, subordinates their behavior.

All this gives grounds to highlight practical recommendations for improving a set of measures to preserve (restore) physical and mental health among law enforcement officers: ensuring the implementation of the policy in the field of occupational health and safety of law enforcement officers, including the identification of cases of critical or chronic stress, substance abuse; promoting a healthy lifestyle; informing law enforcement officers about the availability of various types of psychophysical assistance; involving law enforcement officers in the decision-making process; implementation of a comprehensive action plan to ensure law enforcement officers' preparedness for possible emergencies in the context of social tensions; implementation of work organization measures that promote a normal work-life balance; implementation of programs for law enforcement officers' career development,

taking into account the organization's incentive factors and motivational indicators; development and implementation of a comprehensive health and well-being strategy that includes preventive measures, early detection of problems, assistance and rehabilitation, etc.

CONCLUSIONS

The research revealed a significant ($p \leq .01-.001$) negative dynamics of law enforcement officers' physical and mental health indicators in the context of social tension (COVID-19 pandemic, war, participation in hostilities). The article reveals a low level of functioning of the cardiovascular and respiratory systems; a high level of psychosocial (professional) stress; a low level of satisfaction with life and service; a depressed emotional state; and a significant percentage of law enforcement officers with languishing. All of this negatively affects the effectiveness of their

service activities and requires correction. Practical recommendations for implementing corrective measures to preserve (restore) law enforcement officers' physical and mental health have been developed. Providing law enforcement officers with comprehensive and qualified psychophysical assistance to preserve and restore their health, and implementing a comprehensive health and well-being strategy that includes preventive measures, early detection of problems, assistance and rehabilitation will help improve their physical and mental health in the context of social tension and, accordingly, increase the effectiveness of their professional activities.

PROSPECTS FOR FURTHER RESEARCH

We plan to study the dynamics of physical and mental health indicators of women law enforcement officers under the influence of crises in their professional activities.

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The topic and content of the article correspond to the provisions of the priority areas of research of the National Academy of Internal Affairs within the research work for 2020-2024 under "Psychological, pedagogical and sociological support of law enforcement" (State registration number 0113U008196).

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 12.08.2023

ACCEPTED: 09.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

INFLUENCE OF AQUA FITNESS TRAINING SESSIONS ON IMPROVING THE BIOLOGICAL AGE INDICATORS IN OVERWEIGHT FEMALE STUDENTS

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ABSTRACT

Aim: To experimentally test the influence of aqua fitness training sessions on reducing the rate of aging in overweight female students.

Materials and Methods: The research involved 25 female students aged 17-21 who were overweight. All female students were healthy, not obese, and overweight was associated with their unhealthy diet and insufficient motor activity. These female students were formed into experimental (EG, n = 12) and control (CG, n = 13) groups. Aqua fitness was used in the physical education of the EG students, while the CG students were engaged in dance aerobics. Biological age was studied using V. P. Voitenko's method, which involves assessing the indicators of body weight, arterial blood pressure, static balancing time, and the index of health self-assessment.

Results: The author's methodology of aqua fitness training sessions was developed and experimentally tested, the content of which included specific aerobic, strength and coordination exercises performed against the background of constant tension of the abdominal muscles and reduced load on the joints in the aquatic environment. The positive influence of aqua fitness training sessions according to the author's methodology on the indicators of body weight, static balancing time, and health self-assessment index was revealed.

Conclusions: As a result of aqua fitness training, the EG students had a more significant decrease in the rate of aging of the body than the CG students, which confirms the enhanced health effect of aqua fitness training sessions.

KEY WORDS: female students, aqua fitness, biological age, physical education, health

INTRODUCTION

Modern living conditions are steadily and prematurely depleting human biological and functional reserves. An analysis of the life expectancy and quality of life of Ukrainians shows that there has been a sharp deterioration in the health of all age groups and students in particular over the past decade. In recent years, Ukrainian students' studying peculiarities have been characterized by a decrease in motor activity and an increased level of stress against the background of intensification of the educational process in the context of distance learning due to quarantine restrictions and martial law, which causes premature aging of their bodies [1, 2]. Thus, according to scientists, the average biological age of Ukrainian students is over 40 years [3, 4].

The aging of the body is characterized by morphological, functional and metabolic changes, the manifestation of which increases with age. At the same time, individuals of the same calendar age may differ in biological age, i.e. in the degree of decline in physiological functions,

depletion of adaptive reserves – the intensity of aging. The degree of premature aging is characterized by the difference between the biological age and the calendar age of a person and is an objective criterion for assessing the lifestyle of students and the biological potential of their body's life-sustaining activities. Biological age is an informative indicator of the level of wear and tear of the body and individual aging status, defined as the correspondence of individual biomarker values to the reference population average age norms. Biological age characterizes the overall viability of the organism [5, 6].

The sedentary lifestyle, irrational diet, non-compliance with the daily routine, constant psychological stress and low health culture characteristic of modern students lead to an increase in the number of young people who are overweight. Women are 1.7 times more likely to be overweight than men due to their physiological characteristics. Lifestyle and overweight can lead to functional, somatic, and metabolic disorders that cause premature aging of the body [7-9].

Since the rate of aging can be of real prognostic value for assessing the health of an individual, the study of the biological age of students is an important measure for pedagogical control of the effectiveness of physical education.

Rationally organized motor activity, which arouses interest and has a comprehensive health effect, has potential pedagogical impact on slowing down the age-related aging processes of students' bodies. Research shows that among female students, physical exercises of health and recreational orientation, in particular various types of health fitness, are in special demand, which contribute to increasing the overall working capacity of the body, developing motor skills and improving the functional capabilities of the body in the conditions of various motor modes of active recreation. Aqua fitness is one of the types of health fitness [10, 11]. Scientists have proven that physical exercises in the aquatic environment have no special contraindications for use, enhance the effect of physical load on the body of those who exercise due to the resistance properties of water, and therefore they serve as a multifunctional training simulator [12, 13]. It is known that motor activity in water causes activation of the cardiorespiratory system of the body, acceleration of biochemical and metabolic processes, and is characterized by high energy capacity combined with the phenomenon of gravitational unloading of the musculoskeletal system [14].

In practice, individual aqua fitness programs are formed by synthesizing exercises from swimming, gymnastics, athletics, calisthenics, stretching, dance aerobics, sports games, etc. used in the aquatic environment. This leads to a variation in the intensity of physical load and makes it accessible to female students of different levels of physical fitness. At the same time, it is important to study the effectiveness of aqua fitness training sessions to reduce the rate of aging of their body.

AIM

The aim is to experimentally test the influence of aqua fitness training sessions on reducing the rate of aging in overweight female students.

MATERIALS AND METHODS

The research was conducted from September 2022 to June 2023. The pedagogical experiment involved 25 1-2 instructional year female students aged 17-21 from the Mykhailo Drahomanov Ukrainian State University with excess weight ($BMI = 25.0-29.9 \text{ kg/m}^2$) (they were not obese) who chose fitness as a type of motor activity in the conditions of sports clubs of physical education. All the students were healthy, had no contraindications to training sessions, and overweight was associated with their poor nutrition and insufficient motor activity. These female students were formed into experimental (EG, $n = 12$) and control (CG, $n = 13$) groups, taking into account their interests in physical exercises. The EG female students chose to train according to our aqua fitness program, which included exercises in the water for coordination,

strength and endurance and provided for a targeted effect on functional capabilities and individual muscle groups with a reduced load on the joints. The CG girls chose training sessions in the wellness fitness club and practiced mostly dance aerobics. Training sessions lasted 1 hour and were held twice a week.

The following formula was used to calculate the biological age of female students according to V. P. Voitenko's method [15]:

$$A = -1.46 + 0.42 \times PB_p + 0.25 \times BW + 0.70 \times SHS - 0.14 \times SB,$$
 where BA is biological age, years, PB_p is pulse blood pressure, mm Hg, BW is body weight, kg, SHS is self-assessment of health status, points, SB is static balancing, s.

To determine the intensity of aging of an individual's body, it is necessary to compare the individual value of biological age (BA) with the proper biological age (PBA), which characterizes the population standard of age-related "wear and tear". The proper biological age (PBA) of women is calculated by the formula [15]:

$$PBA = 0.581 \times CA + 17.24,$$
 where CA is calendar age.

At the beginning and end of the academic year, the biological age of female students was diagnosed by the indicators of their body weight (kg), blood pressure (mm Hg), static balancing time (s), and self-assessment of health status index using a special questionnaire (points), and the proper biological age of female students was calculated. The intensity of aging was defined as the difference between the biological age and the proper biological age. At the beginning of the pedagogical experiment, the homogeneity of all indicators of the EG and the CG students was determined by the Shapiro-Wilk W test, and it was found that the distributions of the EG and the CG were normal, which allowed us to assess the reliability of the results using Student's t-test.

The process of implementing the research was built in accordance with the requirements of scientific ethics. The research was approved by the Academic Ethics Commission of Ukrainian State Dragomanov University. The pedagogical experiment was open, its participants were informed about the aim and objectives of the research and voluntarily participated in it.

RESULTS

By examining the biological age of female students, we obtained the data presented in Table 1.

The degree to which the biological age of female students ($n = 25$) exceeds the calendar age is presented in Table 2.

The rate of body aging was estimated by the difference between biological age and calendar age. The distribution of female students by the intensity of body aging is presented in Table 3.

The content of the developed aqua fitness program included exercises of mainly aerobic, strength and coordination orientation. Since the aquatic environment reduces the load on the joints, which is important in case of overweight, it allowed us to perform exercises with full amplitude, static and dynamic strength exercises with a weight. To regulate the intensity of physical load in the content of training sessions, exercises were

Table 1. Characteristics of the calendar, proper and biological age of female students (n = 25) (Mean ± m)

Indicator	CA, years	PBA, years	BA, years	BA-CA, years	Difference, %
Mean value	18.2±1.2	27.8±0.7	44.8±2.7	26.6±2.6	146.2

Table 2. The degree to which the biological age of female students (n = 25) exceeds the calendar age

Excess amount, %	Number of female students, %
by 100% (twice)	21.2
from 100 to 150 % (from 2 to 2.5 times)	36.1
from 151 to 200 % (from 2.5 to 3 times)	27.9
from 201 to 222 % (more than 3 times)	14.8

Table 3. Distribution of female students (n = 25) by the intensity of body aging (BA-PBA)

Difference, years	Rate of aging	Number of persons	%
from -15 to -9	sharply slowed down	0	0
from -8.9 to -3	slowed down	1	4.0
from -2.9 to +2.9	BA = PBA	1	4.0
from +3 to +8.9	accelerated	2	8.0
from +9 to +15	sharply accelerated	21	84.0

Table 4. Correlation between biological and calendar age in the EG (n = 12) and the CG (n = 13) female students under conditions of the pedagogical experiment (Mean ± m)

Indicators (mean value)	Groups	Stages of the experiment		Student's t-test
		Beginning	Ending	
CA, years	EG	18.2±1.1	19.2±1.1	0.64
	CG	18.2±1.2	19.2±1.2	0.59
Student's t-test		0.00	0.00	
BA, years	EG	44.7±2.8	35.1±2.7	2.47
	CG	44.9±2.5	43.8±2.1	0.34
Student's t-test		0.05	2.54	
Difference between CA and BA, years	EG	26.5±2.6	15.9±2.7	2.83
	CG	26.7±2.7	24.6±2.5	0.53
Student's t-test		0.05	2.36	
Difference, %	EG	145.6%	82.8%	
	CG	146.7%	128.1%	

Table 5. Dynamics of indicators of biological age of the EG (n = 12) and the CG (n = 13) female students under conditions of the pedagogical experiment (Mean ± m)

Indicators	Groups	Stages of the experiment		Student's t-test
		Beginning	Ending	
Body weight, kg	EG	80.2±2.2	71.2±1.9	3.10
	CG	79.7±2.8	77.4±2.1	0.66
Student's t-test		0.14	2.19	
Subjective health assessment, points	EG	19.5±1.2	13.2±1.5	3.28
	CG	18.3±1.6	17.5±1.4	0.38
Student's t-test		0.60	2.10	
Pulse arterial blood pressure, mm Hg	EG	42.0±0.81	41.5±0.76	0.45
	CG	42.5±0.90	42.5±0.83	0.00
Student's t-test		0.41	0.89	
Static balancing, s	EG	10.89±0.53	13.31±0.28	4.04
	CG	10.77±0.44	11.75±0.41	1.63
Student's t-test		0.17	3.14	

planned from three main preparatory positions: supporting, neutral and unsupported. The supporting position allowed for pushing off the bottom of the pool, performing various types of movements and jumps. The neutral position was achieved by immersing the body in water up to shoulder level, and movements were performed in a horizontal plane using the lateral resistance of the water. Hovering was a state when the body was kept afloat without support on the bottom of the pool. The water environment or additional equipment such as rubber "blades", armbands, a belt, etc. were used as support. The balance and hanging of the body without support was maintained through vigorous movements of the arms and legs and constant tension of the abdominal muscles. Exercises performed in deep water in an unsupported position did not involve a phase of muscle relaxation, and all movements performed under the influence of water resistance required constant switching of antagonist muscles.

Each training session included a preparatory, main and final part. The preparatory part (15 minutes) included the following exercises: vigorous movements with a short lever arm, running, breathing exercises, types of walking with arm movements, isolated and complex movements of the arms, trunk of the legs with the development of the main joints (ankle, knee, hip, spine, shoulder girdle of the elbow joints), as well as movements of individual muscle groups from local to regional (toe stands with different positions and movements of the arms; half-squats, lunges, bends, body movements forward, to the sides and backward, elements of classical aerobics) performed against music background in the intensity range of 50-60 beats per minute, as well as aqua stretching. The main part of the training session (up to 30 minutes) was held in shallow (1.4 m) and deep (1.8 m) water, using special equipment: flexible sticks, armbands, foamed swimming boards, vests, etc. The main part of the training session included walking, running, jumping with a large amplitude, movements of the arms, body, legs in the mode of aqua jogging, aqua dance, aqua power (aqua building), aqua aerobics, aqua boxing, and distance swimming. Exercise programs were designed to gradually increase physical load, volume, and intensity. The approximate time of continuous work in coordination exercises was 15-30 s at a pulse up to 140 beats/min, in strength exercises (static mode) – 5-12 s at a pulse up to 140 beats/min, in strength exercises (dynamic mode) – 8-15 s at a pulse of 150-160 beats/min. Static aqua fitness exercises were performed with a small number of repetitions (3-4 times for 3-6 s with rest pauses of 10-20 s); dynamic exercises – with a large number of repetitions in one series, a longer rest pause between them and a smaller number of serial approaches, respectively (20-30 times with a rest interval of up to 1.5 min in 2-3 series). In this regard, pauses were planned to be active in dynamic exercises. For development of muscular strength by means of aqua fitness the traditional approach was applied – exercises with a weight, and also rhythmic exercises with own body weight (collapsing and spreading, squats, holding a posture, etc.). The number of repetitions depended on the amount of weight and ranged from 6-8 times for the development of muscle strength in exercises with greater resistance, 24-32 times in exercises with

lesser resistance for the development of strength endurance, respectively. The correct body position and coordinated breathing were monitored during the entire training session. Stretching exercises (stretching) were performed before and after the main part of the training session. In the preparatory part of the training session, stretching created opportunities for warming up muscles, which prevented injury, and in the final part, the use of stretching promoted muscle elasticity. In the final part of the training session (up to 15 minutes), distance swimming, hydro relaxation, slow compositions, and muscle relaxation exercises were used.

Assessment of the biological age of the EG and the CG female students at the beginning and end of the academic year showed a positive trend in reducing the rate of aging of the body of students of both groups, but the decrease in the rate of aging of the body in the EG was reliable, and in the CG – unreliable. The difference between the indicators at the beginning and end of the experiment in the EG was 9.6 years, and in the CG – 1.1 years. The difference between the indicators of biological age in the EG and the CG students at the end of the experiment was 8.7 years and was reliable (Table 4).

The analysis of the difference between biological and calendar age at the end of the academic year showed that the amount of excess of biological age over calendar age in the EG female students significantly decreased by 10.6 years, and in the CG – by 2.1 years. However, the excess of biological age over calendar age still remained high in female students of both groups (in the EG female students by 1.8 times, in the CG female students by 2.3 times). The dynamics of individual indicators of biological age of female students under the conditions of the pedagogical experiment is presented in Table 5.

Thus, at the end of the academic year, the EG girls significantly decreased their body weight, improved the results of static balancing and subjective health assessment, while the CG female students did not show statistically significant changes in any indicator. The data obtained indicate a more pronounced health-improving effect of aqua fitness and the benefits of its use to reduce the rate of aging in overweight female students.

DISCUSSION

Many scientists [6, 8, 16] point out that the lack of a healthy lifestyle and low levels of motor activity cause a sharply accelerated rate of aging, which is typical for people of all age groups, reflecting the general trend of deteriorating quality of life, health, and low levels of physical fitness of Ukrainian citizens, including students, and raises the task of preventing premature aging as a strategic one.

The results of our research confirm the idea that the correlation between biological age, proper age, and calendar age describes the degree of loss of general health and vitality of the body. At the same time, enhanced body mass index indicators are associated with a slowdown in metabolic processes, deterioration in morphological and functional parameters of the body, and may increase the rate of aging. Since the physiological, morphological, functional and adaptive capabilities of the body determine

the biological age of a person, the most rational anti-aging agent is rationally organized motor activity to mobilize the mechanisms of vitality to ensure longevity and prevent premature aging.

For more effective mobilization of mechanisms aimed at preserving life-sustaining activities and resisting old age, it is necessary that the choice of types of motor activity of female students is based primarily on their interests and the expected health effect. Motor activity of overweight female students should be aimed at increasing the overall fitness of the body, enhancing metabolic processes, improving the function of blood circulation and respiration, the nervous system, and normalizing weight. Our research is consistent with the results of other authors who argue that exercises in water increase the impact of physical load, as the aquatic environment activates complex biological processes in the body that contribute to the normalization of cardiovascular, respiratory, musculoskeletal, endocrine and other functions [17]. Thus, hydraulic pressure and water resistance during movement compress the chest and abdomen, preventing exhalation into the water and inhalation. This contributes to the development of respiratory muscles and lung capacity. Improved cardiovascular functioning is determined by the compression properties of water. Active exercises in water accelerate metabolism, are characterized by higher energy capacity of physical load, involvement of almost all muscle groups, the phenomenon of gravitational unloading of the musculoskeletal system, and the presence of a stable hardening effect [18]. Background music promotes psychological relaxation and positive emotions.

When using aqua fitness for overweight people, it is necessary to focus on the effect that provides three types of water resistance properties: direct, vortex and viscous. For example, when the body is immersed in water, it is subject to direct resistance, which requires several times more effort to overcome than on land. This effect of the water environment promotes uniform muscle development, improves posture, increases the functional reserves of the cardiovascular system, and requires significant energy expenditure. Body movements in water form vortex flows, which causes vortex resistance, i. e. turbulence, the strength of which depends on the speed of movement. This resistance necessitates tension of the abdominal muscles and vigorous movements to

maintain balance and movement. At the same time, a rapid change of movements increases muscle tension to maintain balance, and the viscosity of water causes an increase in muscle effort during exercise [19].

The research confirmed that aqua fitness training sessions has a positive effect on weight loss, improvement of static balancing results, and subjective health assessment. All this indicates a more pronounced health effect of aqua fitness and the benefits of its use to reduce the rate of aging of the body of overweight female students.

CONCLUSIONS

The author's aqua fitness program was developed, which included exercises of mainly aerobic, strength, and coordination orientation. Each individual training session included a preparatory, main and final part. The preparatory part (15 minutes) included the following exercises: vigorous movements with a short lever arm, running, breathing exercises, types of walking with arm movements, isolated and complex movements of the arms, trunk of the legs with the development of the main joints, as well as movements of individual muscle groups from local to regional. The main part of the training session (up to 30 minutes) was conducted in shallow (1.4 m) and deep (1.8 m) water, using special equipment: flexible sticks, armbands, foamed swimming boards, vests, etc. The main part of the training session included walking, running, jumping with a large amplitude, movements of the arms, body, legs in the mode of aqua jogging, aqua dance, aqua power (aqua building), aqua aerobics, aqua boxing, and distance swimming. In the final part of the training session (up to 15 minutes), distance swimming, hydro relaxation, slow compositions, and muscle relaxation exercises were used.

The positive effect of aqua fitness training sessions according to the author's methodology on body weight, static balancing time, and health self-assessment index in the EG students was revealed. As a result of aqua fitness training sessions, the EG female students had a more significant decrease in the rate of body aging than the CG female students, which confirms the enhanced health effect of aqua fitness training sessions.

Prospects for further research will be aimed at studying the effect of aqua fitness training sessions on the intensity of aging of overweight women of the first mature age.

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This study was carried according to the research plan of the Faculty of Physical Education, Sports and Health of the Ukrainian State Dragomanov University in 2023-2024 in accordance with the theme "Monitoring, control and evaluation of learning results in physical culture, the basics of healthy lifestyle" (state registration number 0113U009185).

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 19.08.2023

ACCEPTED: 10.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

PEDAGOGICAL CONDITIONS FOR THE FORMATION OF THE READINESS OF FUTURE SPECIALISTS IN PHYSICAL REHABILITATION TO WORK WITH ATHLETES OF WATER SPORTS IN THE PROCESS OF PROFESSIONAL TRAINING

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ABSTRACT

Aim: To experimental verification of pedagogical conditions for the formation of the readiness of future specialists in physical rehabilitation to work with athletes of water sports in the process of professional training.

Materials and Methods: The experimental work was carried out in the period from 2017-2022 and covered three stages that determined the program of the pedagogical experiment. 204 students were involved in the experiment to check the effectiveness of pedagogical conditions (EG passed 103 students, CG – 101). Experimental research was carried out on the basis of higher education institutions of Ukraine: Khmelnytskyi National University, H.S. Skovoroda Kharkiv National Pedagogical University, Kamianets-Podilsky Ivan Ohienko National University. Research methods: analysis of scientific and methodical literature; pedagogical observation; pedagogical experiment; pedagogical testing; methods of mathematical statistics.

Results: During the comprehensive diagnostic testing during the formative stage of the experiment, the majority of EG students demonstrated a high and medium level of readiness to work with water sports students (high – 30.10 %, average – 51.46 %), and only 18.44 % of EG students revealed a low level of readiness. At the same time, a slightly different indicator was recorded in CG: high level – 10.89 %, average – 38.61 %, low – 50.50 %.

Conclusions: Therefore, the presented quantitative and qualitative analysis of the results of the experiment recorded positive dynamics in the levels of students' readiness to work with water sports athletes after experimental training and the introduction of pedagogical conditions regarding the determined component structure of the studied readiness, of their criterion indicators and parameters of formation, which took place during the experimental testing.

KEY WORDS: readiness, future specialists in physical rehabilitation, athletes of water sports, professional training, formation

INTRODUCTION

At the current stage of socio-economic development of Ukraine and reformation processes in education, the requirements for the quality of training of specialists in the fields of physical culture and sports and health care, which are determined by the goals and needs of these industries, are increasing. The appearance of innovative organizational and methodical forms of physical culture, health-preserving technologies, activation of the development of the fitness industry, revision of the content of «traditional» professions in this field and the emergence of new ones, such as: fitness trainer, physical therapist, occupational therapist, physical recreation specialist, physical rehabilitation specialist, etc. became characteristic features of these transformational changes and transformations.

The relevance of the declared problem is due to a thorough analysis of the domestic «Profession Classifier» DK 003:2010 (2010, with changes and additions from 2016), the content of which indicates the introduction of a new professional job title – 3226 «specialist in physical rehabilitation», and the ISCO-08 International Classifier, according to which specialty 2264 «physiotherapist» is included in block 226 «Other health care specialists». In view of this, domestic institutions of higher education carry out active training of specialists of the first (bachelor's) and second (master's) levels of higher education in specialty 227 «Physical Therapy, Occupational Therapy». The researched scientific problem is multifaceted and interdisciplinary, its thorough understanding and development of theoretical, methodological and practical foundations are based on the scientific work of teachers,

psychologists, doctors, physiotherapists, specialists in the fields of health care, physical culture and sports, sports medicine, etc.

AIM

The aim of the study is to experimental verification of pedagogical conditions for the formation of the readiness of future specialists in physical rehabilitation to work with athletes of water sports in the process of professional training.

MATERIALS AND METHODS

The experimental work was carried out in the period from 2017–2022 and covered three stages that determined the program of the pedagogical experiment. Just before the experiment to check the effectiveness of pedagogical conditions formation of readiness of future specialists in physical rehabilitation to work with water sports athletes were involved in the process of professional training 204 students (EG passed 103 students, CG – 101). Experimental research was carried out on the basis of higher education institutions of Ukraine: Khmelnytskyi National University, H.S. Skovoroda Kharkiv National Pedagogical University, Kamianets-Podilsky Ivan Ohienko National University.

At the first, preparatory stage of the research (2017–2020 year), the state of research on the pedagogical problem of forming the readiness of future physical rehabilitation specialists to work with water sports athletes in the process of professional training was analyzed; the essence of the main concepts from the raised problem in the context of definitive analysis was clarified; the professional profile of a specialist in physical rehabilitation was developed; the structure of the readiness of future physical rehabilitation specialists to work with water sports athletes was characterized and the current state of their professional training was analyzed. At this stage, the attitude of teachers regarding the need to form future physical rehabilitation specialists readiness to work with water sports athletes had been clarified requirements to carry out practical activities in the field of development and implementation of physical rehabilitation programs for athletes of water sports; about the need for an educational discipline for the formation of future physical rehabilitation specialists' readiness to work with water sports athletes; about the actual teaching of the academic discipline for the formation of future physical rehabilitation specialists' readiness to work with water sports athletes.

In the course of the study, it was found that the teachers of the HEIs confirmed the expediency and need to increase the effectiveness of the professional training of future physical rehabilitation specialists to work with water sports athletes by defining and implementing productive pedagogical conditions, based on modern methods of formation of professional competence of higher education seekers, which will ensure the formation of researched readiness. The conclusion was formulated that research attention should be devoted to the definition and scientific substantiation of criterion indicators of the manifestation

of readiness under study, as well as the need to create pedagogical conditions for its formation in the process of professional training.

During the second, ascertaining stage (2020–2021 year), higher educational institutions, which train future specialists in physical rehabilitation, were selected, on the basis of which research and experimental work was planned; a confirmatory diagnosis of the readiness of future physical rehabilitation specialists to work with water sports athletes in the process of professional training was carried out. A set of pedagogical conditions was singled out (development of positive motivation of students to the formation of their readiness to work with athletes of water sports; development and introduction into the professional training system of students of the special course «Physical Rehabilitation of Water Sports Athletes»; enrichment of the creative potential of students through the activation of scientific research work on the problems of physical rehabilitation of water sports athletes).

The third, formative stage (2021–2022 year), provided for the direct introduction into the process of professional training of students of pedagogical conditions for the formation of the readiness of future physical rehabilitation specialists to work with water sports athletes. At the same stage, the results of the implementation of the specified pedagogical conditions were analyzed, their quantitative and qualitative analysis was carried out using the methods of mathematical statistics. Thus, the formative stage was aimed at studying the dynamics of the studied readiness directly in the process of specially organized professional training of future specialists in physical rehabilitation and active formation of the studied components of readiness (informational-cognitive, motivational-value, operational-activity, self-educational-professional).

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

- *theoretical*: analysis, synthesis, comparison, juxtaposition (for the study of scientific sources, regulatory documents, experience of professional training of future specialists in physical rehabilitation in higher education institutions; determination of methodological approaches to solving the problem of forming the readiness of future physical rehabilitation specialists to work with water sports athletes during professional training); 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 in the process of their professional training (to identify the levels of readiness of future physical rehabilitation specialists to work with water sports athletes); pedagogical experiment (to check the effectiveness of the identified pedagogical conditions for the formation of the readiness of future physical rehabilitation specialists to work with water sports athletes in the process of professional training); pedagogical modeling (for the development of

a structural and functional model of the formation of the readiness of future specialists in physical rehabilitation to work with water sports athletes in the process of professional training);

- *statistical*: for mathematical processing of pedagogical experiment data, quantitative and qualitative analysis of research results and proving their statistical reliability, graphic visualization (descriptive statistics, determination of statistical significance of differences between groups by the Student's method and correlation analysis by the Pearson method).

The Ethics Commission of V.G. Korolenko Poltava National Pedagogical University has no comments on the methods used in this study.

RESULTS

The knowledge and skills acquired by the teachers made it possible to adjust the process of implementing *the first pedagogical condition* accordingly, to determine the expediency of using certain forms, methods and means of motivation in the process of professional training of future specialists in physical rehabilitation from experimental group to work with water sports athletes.

Therefore, during the formative stage of the experiment, the propaedeutic-motivational stage of the implementation of the first pedagogical condition, the aim was to gradually immerse the EG students in the atmosphere, favorable for the emergence of deep positive impressions regarding work with water sports athletes, its content, forms and methods of implementation. This contributed to increasing the level of activity of EG students and their willingness to study the problem of the work of a specialist in physical rehabilitation with water sports athletes. The application of lectures-visualizations, guest lectures, binary lectures, meetings with specialists who work with athletes, in particular, with water sports athletes, in the process of studying professional disciplines, was aimed at activating the motivational sphere of EG students.

As a result of pedagogical observation, it was recorded that the didactic toolkit of the cognitive-motivational stage of implementation of the first pedagogical condition during the study of professional disciplines (interactive and multi-lectures, multi-seminars, lectures-consultations, various forms of independent and individual work (webquests, educational projects)), and search for information involving new sources of information, simulation method, etc.), provided a positive result for our research, namely: it was observed that EG students actively systematized the acquired knowledge and independently found information about the specifics of the physical rehabilitation specialist's work with water sports athletes.

During the formative stage of the experiment, the analytical and motivational stage of the implementation of the first pedagogical condition, the goal was to form the individual work style of the EG student, as a future specialist with water sports athletes and his ability to perform analytical activities in the context of researching the specifics of the physical rehabilitation specialist's work with the above-mentioned

athletes. This provided a number of forms and methods of teaching professional disciplines (coaching methods, including the method of coaching conversations; specific situations; emotional stimulation; positive assessment of the situation; creating a situation of cognitive discussion; experience modifications; «Timeline», «Board of Directors», «Balance Wheel», GROW Model; webcoaching); methods of information analysis, document analysis, content analysis, biostatistical analysis; methods of self-motivation, etc.), the presence of appropriate level of mental actions and analytical skills in EG students, their professional self-awareness, competence and identity, the ability for analytical activity and self-motivation.

The content resource of the research and experimental work, aimed at the development of positive motivation of EG students to form their readiness to work with water sports athletes, interest in this issue, was implemented in the process of teaching a number of professional disciplines, which, on the basis of free choice, were chosen by the teachers participating in the pedagogical experiment, by supplementing the topics of lectures and practical classes with informational content of a motivational nature, practice-oriented tasks, meetings with therapists, physiotherapists, study of practical experience of teachers.

Within the framework of the implementation of *the second pedagogical condition* (development and introduction into the system of professional training of students of the special course «Physical rehabilitation of athletes of water sports»), for EG students. The content resource of research and experimental work at the stage of implementation of the special course was implemented on the basis of informational, axiological, activity, personal creative, integrative, and professional approaches, as well as didactic (clarity, systematicity and consistency, accessibility, awareness and activity, scientific) and specific principles (aware perspective, openness, innovativeness). In accordance with the methodological toolkit, a distance course «Physical rehabilitation of water sports athletes» was developed using the Google Sites service, because this service allows you to use full-fledged functionality for high-quality distance learning.

It should be noted that only EG students were given access to the distance learning course in order to maintain the purity of the experiment. Therefore, the educational content of the special course was closed for other students.

During the application of the narrative method at the formative stage of the experiment, it was found that the students liked the content of the special course «Physical rehabilitation of water sports athletes». This type of work with EG students is a positive practice of emphasizing the basics of working with water sports athletes. Students actively participated in a thorough study of the methods of organizing special physical training and working capacity of water sports athletes, mastering the means of physical rehabilitation, methods of developing individual rehabilitation programs after injuries, methods of application in such programs of physical exercises, massage, movement therapy, water procedures, physical procedures, exercise therapy with

the aim of restoring the motor activity of those who love or professionally engage in water sports.

The quality of the teaching of the author's special course «Physical rehabilitation of water sports athletes» was evaluated by us with the help of a technological map of system analysis and evaluation of its effectiveness developed by us. The results of the evaluation of classes from the special course (9 lectures, 9 practical works, 16 classes of the practicum on physical rehabilitation of water sports athletes) are shown in Fig. 1.

So, lectures on the subject of the special course were evaluated as follows: 78 % of lectures were marked as «excellent», 11 % of lectures – as «good», 11 % of lectures – as «satisfactory». The effectiveness of conducting practical classes was evaluated in such a way that 56 % were marked as «excellent», 22 % were marked as «good» and 22 % were marked as «satisfactory». Among the classes held within the framework of the workshop on physical rehabilitation of water sports athletes, 63 % were rated as «excellent», 25 % were rated as «good», 13 % were rated as «satisfactory».

Within the framework of the implementation of the *third pedagogical condition* (enrichment of the creative potential of students through the activation of research work on the problems of physical rehabilitation of water sports athletes), EG students were invited to participate in the scientific studio «Problems of physical rehabilitation of water sports athletes». Incidentally, we note that the format of the activity of the scientific studio during the formative experiment was online in connection with the distance educational process at the HEIs in the conditions of the pandemic. For the purpose of remote communication with EG students during sessions and sectional classes, the functionality of the Google Classroom service was developed and used to create a virtual site of the scientific studio «Problems of physical rehabilitation of athletes in water sports». EG students received a virtual class code for the period of participation in the experiment.

In this way, the principle of multi-level acquisition of knowledge by EG students in the field of physical

rehabilitation of water sports athletes was realized as a theoretical justification of their relevance, the need for a scientific search for their solution, development of models and programs of physical rehabilitation for water sports athletes.

During the application of the method of narratives at the formative stage of the experiment, it was found that the EG students especially liked the format of research work at the sessions of such scientific studio as «Inform-digest», when they had to prepare, uniting in mini-groups, short, interesting and bright messages on various topics related to the activities of physiotherapists with an emphasis on work with athletes in our country and abroad; TV program «How it was», when invited practitioners highlighted some significant events in their own activity as a physiotherapist, and students learned about the professional achievements of physical rehabilitation specialists who work, in particular, with water sports athletes; master classes of practitioners in various types of massage, phytotherapy, aromatherapy, mechanotherapy, hydrotherapy, etc.; conferences at which the scientific and methodological achievements of the teachers of the departments of physical therapy, occupational therapy with sports medicine and physical rehabilitation of the HEIs and, accordingly, students of the EG were highlighted.

Summarizing the characteristics of the process of implementing pedagogical conditions for the formation of students' preparedness under study, we note that in this process the students of EG used the educational and methodological support developed by us: 1) distance course «Physical rehabilitation of water sports athletes»; 2) educational manual «Physical rehabilitation, sports medicine»; 3) virtual platform of the scientific studio «Problems of physical rehabilitation of water sports athletes»; 4) electronic textbook «Physical rehabilitation, sports medicine (context of work with athletes of water sports)».

An evaluation of the results of the influence of an experimental set of pedagogical conditions on the level of readiness of future physical rehabilitation specialists (EG

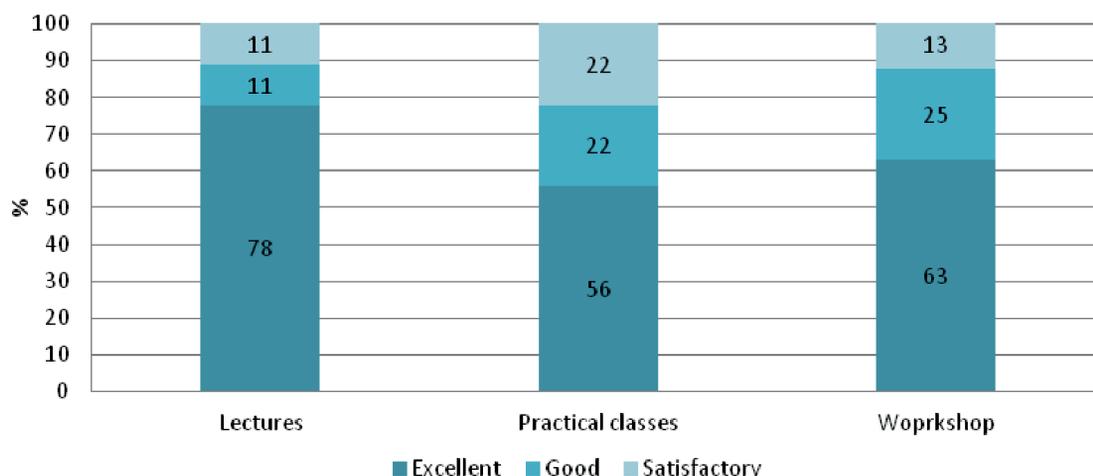


Fig. 1. Evaluation of the effectiveness of special course classes (in %)

students) to work with water sports athletes in the process of professional training was carried out. The program of the pedagogical experiment provided for a comparison of the current results of professional training of EG students and the final results of professional training of students to work with athletes of water sports in control group (CG) and EG.

In order to prove the effectiveness of pedagogical conditions for forming the readiness of EG students to work with water sports athletes in the process of professional training, the goal was set to monitor the quantitative changes in the levels of each of the determined components of readiness, and therefore to reveal the general level of this readiness. Within the scope of the experimental work, it was assumed that a comparison of the levels of readiness of future physical rehabilitation specialists to work with water sports athletes in CG and EG at the end of the pedagogical experiment would reveal existing and significant differences between them in these levels and prove the effectiveness of the professional training.

Quantitative characteristics of the formative complex diagnostics of the levels of readiness of EG and CG students to work with water sports athletes are shown in Table 1.

It should be noted that readiness to work with these athletes depends from the volume, level of assimilation and quality of the system of theoretical knowledge on the basics of physical rehabilitation of athletes of water sports, informational awareness of methods and techniques of rehabilitation, as well as methods of organizing information activities in the context of physical culture and sports rehabilitation, health and recreational motor activity, and health preservation of these athletes. The corresponding knowledge system was characterized by the information-cognitive component of readiness. During the comprehensive diagnostic testing during the formative stage of the experiment, the majority of EG students demonstrated a high and medium level of readiness to work with water sports students (high – 30.10 %, average – 51.46 %), and only 18.44 % of EG students revealed a low level of readiness. At the same time, a slightly different indicator was recorded in CG: high level – 10.89 %, average – 38.61 %, low – 50.50 %.

The facts presented in Table 1 show that the vast majority of EG students after the experiment showed average (43.69 %) and high (26.21 %) levels of the motivational-value component of the studied readiness. The indicator of low level in EG was 30.10 %. Let us emphasize that during the pedagogical observation of the formative stage (interviews with students, teachers, the method of narratives) it was found that this component in the structure of the readiness of the future physical rehabilitation specialist to work with water sports athletes was the most difficult to form. Formative diagnostics of results in CG recorded significantly lower indicators, namely: high level – 10.89 %, average – 30.69 %, low – 58.42 %.

Analysis of test results in the testorium system shows that students are interested in the problem of physical rehabilitation of water sports athletes in its practical aspect. Special attention of EG students was given to the practical

classes of the special course, the workshop on physical rehabilitation of water sports athletes, the master classes, during which they had the opportunity to apply in practice, perform professional actions and operations that may be required of a specialist in physical rehabilitation within the limits of his professional functions regarding water sports athletes. The degree of manifestation of the ability to apply in practice, the activity and organizational abilities of EG students to «grow» in education, profession, the ability to analyze one's level of professional competence and master new knowledge in accordance with the requirements of the field of rehabilitation services and restoration of motor activity and health of water sports athletes was recorded by the operational-activity component of readiness, whose level characteristics were distributed as follows: high level – 30.10 %, average – 53.40 %, low – 16.50 %. On the other hand, only 12.87 % showed a high level in CG, 40.59 % showed average level, and 46.54 % showed low.

During the formative experiment, it was found that students are concerned about the organization of self-education, self-control during educational activities, professional self-esteem and professional growth. Emphasizing the research attention during the implementation of the specified pedagogical conditions on these important issues for students made it possible to form the readiness of EG students as future specialists in physical rehabilitation to work with water sports athletes according to the self-educational and professional component. Complex formative diagnostics revealed that 20.39 % of students showed a high level of readiness for this component in the EG, average – 40.78 %, low – 38.83 %. On the other hand, only 12.87 % showed a high level in CG, 39.60 % showed average, and 47.53 % showed low.

Further comparative analysis of experimental data shows that after the formative experiment, positive dynamics were observed in EG (Table 2): the number of students who, at a high level, demonstrate completeness, depth, systematicity, flexibility, universality, generalization of knowledge on the basics of physical rehabilitation and health care of athletes, who are engaged in water sports, have the methods and techniques of rehabilitation of water sports athletes increased significantly (by 15.53 %); demonstrate a wide range of ways of organizing information activities in the context of physical culture and sports rehabilitation, health and recreational motor activity, as well as efficiency in obtaining new knowledge; interest in the problem of physical rehabilitation of water sports athletes, in the chosen profession of a physiotherapist and a pronounced positive attitude towards working with water sports athletes; creatively approach the development and implementation of a physical rehabilitation program for water sports athletes, during health-rehabilitation classes with them using physical exercises, traditional and non-traditional types of massage; have the methods and techniques of educational work with these athletes in the process of physical rehabilitation, promotion of a healthy lifestyle; are able to clearly organize their own educational activities, are active in acquiring knowledge,

Table 1. Formation of students' readiness to work with water sports athletes after experimental training

Components of readiness	Groups	High level	Medium level	Low level	High level	Medium level	Low level
		Absolute indicator (persons)			Relative indicator (%)		
Informational-cognitive	CG	11	39	51	10.89%	38.61%	50.50%
	EG	31	53	19	30.10%	51.46%	18.44%
Motivational-value	CG	11	31	59	10.89%	30.69%	58.42%
	EG	27	45	31	26.21%	43.69%	30.10%
Operational-activity	CG	13	41	47	12.87%	40.59%	46.54%
	EG	31	55	17	30.10%	53.40%	16.50%
Generalized indicator	CG	12	38	51	11.88%	37.62%	50.50%
	EG	27	49	27	26.21%	47.58%	26.21%

Table 2. Dynamics in the levels of students' readiness to work with water sports athletes after experimental training

Components of readiness	Groups	High level	Medium level	Low level	High level	Medium level	Low level
		Absolute indicator (persons)			Relative indicator (%)		
Informational-cognitive	CG	2	4	-6	1.98%	3.96%	-5.94%
	EG	21	15	-36	20.39%	14.56%	-34.95%
Motivational-value	CG	3	2	-5	2.97%	1.98%	-4.95%
	EG	18	13	-31	17.48%	12.62%	-30.10%
Operational-activity	CG	1	3	-4	0.99%	2.97%	-3.96%
	EG	16	20	-36	15.53%	19.42%	-34.95%
Generalized indicator	CG	2	3	-5	1.98%	2.97%	-4.95%
	EG	16	16	-32	15.53%	15.53%	-31.07%

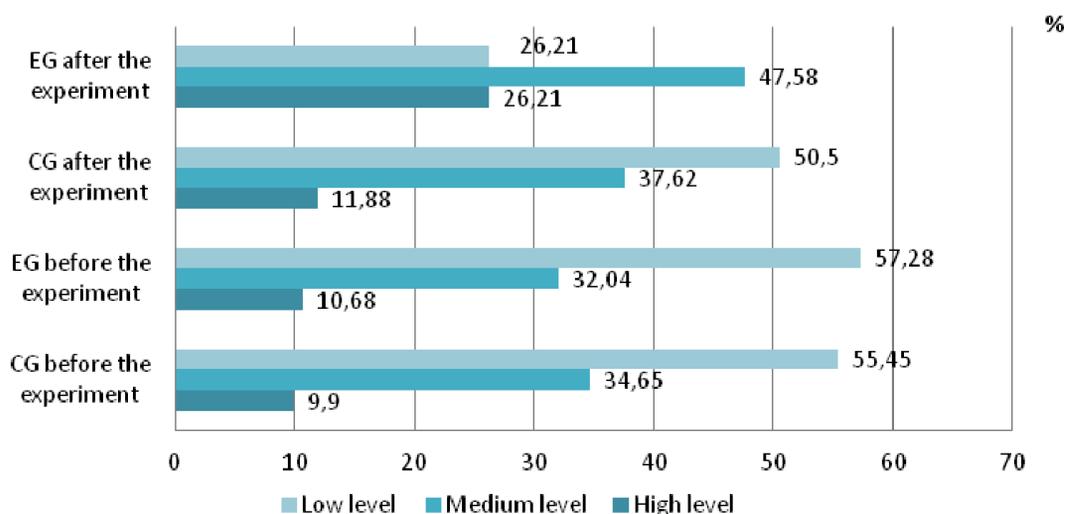


Fig. 2. Histogram of the summary data of the results of the pedagogical experiment

participate in various events in HEIs, research work devoted to the problems of physical rehabilitation of water sports athletes; are able to analyze, generalize, systematize their own knowledge, are active in searching for new information and building knowledge.

The number of EG students who showed an average level of readiness to work with water sports athletes increased (by 15.53 %). At the same time, the number of EG students, whose readiness level is characterized as low (by 31.07 %), has decreased. In CG, it is worth noting, certain positive changes also took place, but since they were insignificant (high level – an increase of 1.98 %, medium level – an increase of 2.97 %, low level – a decrease of 4.95 %), they did not affect on the general picture of the level of formation of the studied readiness.

The conducted research and graphic visualization of the summary data of the obtained results (before and after the pedagogical experiment) using a bar histogram with grouping (Fig. 2) allows us to visually observe the growth of high and medium levels of students' readiness to work with water sports athletes in EG and the reduction of the low level readiness after the introduction of pedagogical conditions.

DISCUSSION

The basis of the research search was the ideas formulated in the works of domestic and foreign scientists, such as: theoretical and practical aspects of professional training of future specialists in physical rehabilitation in higher education institutions and ways to improve this training were studied by [1-3]; study of domestic and foreign experience of training specialists in physical rehabilitation was studied by [4-6]; determination of the role of a specialist in physical rehabilitation in the health care system was considered by [7-10] the scientific and methodological principles of improving the qualification of physiotherapists, research in the field of physiotherapy, assessment of physiotherapist students were presented in works of [11-16]; organizational and methodical aspects of professional training of physical rehabilitation specialists to work with athletes were studied by [17-21].

Certain aspects of the problem of training future specialists in physical rehabilitation were the subject of a number of dissertation studies, including: theoretical and methodological principles of training future specialists in physical rehabilitation for health care activities [22, 23]; formation and development of motivational orientation of future specialists in physical rehabilitation for successful professional activity [24], identification and implementation of interdisciplinary connections in the education of professionally oriented disciplines during the professional

training of future physical rehabilitators [25], issues of employment of physical rehabilitation specialists [26, 27], determination of professional functions of physical rehabilitation specialists [28], clinical activity of physical rehabilitation specialists [29], organizational and pedagogical conditions of professional training of physical rehabilitation specialists to work with athletes [30]. Scientists focus attention on the correct selection of those criteria that are the most important in a pedagogical experiment, because such criteria make it possible to determine the property that is the subject of research. However, there are currently no works dedicated to the problem of developing the components of the formed readiness of future physical rehabilitation specialists to work on restoring the health of athletes.

CONCLUSIONS

The proposed pedagogical conditions for the formation of the readiness of future specialists in physical rehabilitation to work with athletes of water sports in the process of professional training, implemented in accordance with a specially developed program, are effective, which is confirmed by the statistical processing of data obtained during the pedagogical experiment.

Therefore, the presented quantitative and qualitative analysis of the results of the experiment recorded positive dynamics in the levels of students' readiness to work with water sports athletes after experimental training and the introduction of pedagogical conditions regarding the determined component structure of the studied readiness, of their criterion indicators and parameters of formation, which took place during the experimental testing.

Obviously, the developed program of experimental research for approbation pedagogical conditions in the process of professional training contributed to a clear solution to issues of a theoretical-methodical and organizational-pedagogical nature. The results obtained during the stages of the experiment were analyzed, summarized and discussed at the departments whose teachers participated in the experiment, as well as during our presentations at scientific and practical conferences.

The analysis of the results of the experiment allows us to come to the conclusion that, based on the obtained experimental data and the verification of their statistical reliability, the hypothesis of our research was confirmed: after the implementation of a set of pedagogical conditions for the formation of the readiness of future specialists in physical rehabilitation to work with athletes of water sports in the process of professional training, it is possible to achieve positive dynamics in the levels of the studied readiness.

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The article was written in accordance with the topic of the research work "Self-regulation of successful educational activity of students and student youth" (state registration number 0118U004309) of the Department of Pedagogical Excellence and Management named I. A. Ziyayun, V.G. Korolenko Poltava National Pedagogical University. Research was financed by authors.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 10.07.2023

ACCEPTED: 05.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

PREPARATION OF FUTURE SPECIALISTS IN PHYSICAL CULTURE AND SPORTS WITH AN AIM OF PRESERVING AND RESTORING PHYSICAL AND MENTAL HEALTH OF INDIVIDUALS

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ABSTRACT

Aim: The aim of the research is to reveal the specifics of the influence of the educational and training process in physical culture and sports on the physical and mental health of a person in terms of its preservation and restoration.

Materials and Methods: Achieving the goal and solving the set tasks was facilitated by the use of a complex of research methods: theoretical-for the development of a model of the organisation of independent educational and training activities among future physical culture and sports specialists; empirical-for studying the specifics of the influence of physical culture and sports on the physical and mental health of a person.

Results: The modern system of domestic education in higher education institutions is characterized by the transition from descriptive to modelling. That is why a model of the organization of independent educational and training activities of future physical culture and sports specialists regarding the preservation and restoration of physical and mental health of a person has been developed, which is the result of theoretical and practical research.

Conclusions: All things considered, for the effective training of future physical culture and sports specialists it is essential to create an independent organization of the educational and training process regarding preserving and restoring a person's physical and mental health and to build the educational process according to the developed model.

KEY WORDS: physical culture and sport, physical health, mental health, preservation and restoration of physical and mental health

INTRODUCTION

In the field of physical culture and sports, the issue of training competent specialists capable of solving complex specialized tasks and practical problems, including the preservation and restoration of physical and mental health of a person, characterized by the complexity and uncertainty of conditions, is gaining special relevance [1]. After all, in society, along with communicative, value-orientational and cognitive activities, physical culture and sports activities are becoming more and more important, with the help of which a person realizes themselves, reveals his physical abilities and sports capabilities, as well as strengthens and restores his mental and physical health. The issue of training future physical culture and sports specialists to preserve and restore human physical and mental health attracts special attention of the public: scientists, physical culture and sports workers, rehabilitation specialists, education workers [2-4]. We associate the practical solution of these issues with the implementation of a complex program of socio-economic development of society, which includes

the involvement of young people in sports through the promotion of a healthy lifestyle and physical hardening, rehabilitation of a person by means of physical exercises and sports training. That is why the issue of training future physical culture and sports specialists to preserve and restore human physical and mental health is an urgent social and pedagogical problem that requires theoretical development and practical solutions [4, 5].

AIM

The purpose of the study is to reveal the specifics of the influence of the educational and training processes in physical culture and sports on physical and mental human health in terms of its preservation and restoration.

Research the hypothesis is the assumption that the preservation and restoration of physical and mental health will be essential if the motor is properly organized activity or educational and training process. It is possible to provide only by a competent specialist in physical culture and sports.

MATERIALS AND METHODS

Achieving the goal and solving the set tasks was facilitated by the use of complex of research methods, including: theoretical (analysis, synthesis, comparison, systematisation of theoretical and research data, generalization of literature) for the development of a model for organizing independent educational and training activities in future physical culture and sports specialists; empirical (observations, conversations, methods of system-structural and modelling, study and generalization experience of the educational and training process) to study the peculiarities of the influence of physical education and sports for physical and mental health for a person).

RESULTS

The modern system of national education in higher education institutions is characterized by a transition from descriptive to modelling. That is why the organization model of independent educational and training activities of future physical specialists in culture and sports regarding the preservation and restoration of the physical and mental human health was developed, which is the result of theoretical and practical research.

Model of organization of independent educational and training activities for future specialists in physical culture and sports regarding preservation and restoration physical and mental health of a person visualizes the actual process of organization an independent work of students on the formation of abilities and skills of educational and training activities. Special attention in the training of future specialists of physical culture and sports to the independent organization of the educational and training process is focused on the choice of pedagogically appropriate forms and methods of teaching students through the introduction of approaches and technologies, as well as an application of health-saving technologies. Implementation of pedagogical technologies is based on application innovative methods and forms of education, gives an opportunity to solve problems personally oriented training, humanization, differentiation, formation individual educational perspective of future specialists [10]. The author's model involves the formation of students' creative approach to the future professional activity. After all, in modern conditions, professional skill is formed mainly during independent work, but the level of skill is formed within the educational institution, therefore a new approach to education needs to be used.

The study organized an educational process from positions of problem-based learning, since the problem-based approach is a "synthesis of many modern methods of problem-based learning, which are based on the concept of developmental education" [5]. In addition, in institutions of higher education the problem-based learning is widely used. That is why the students' training tried to direct the development of their critical thinking and research skills so that they can in their future professional activities fulfil the tasks set before them and adapt to new conditions preserving and restoring a person's physical and mental health. The analysis of scientific literature proves that scientists define differently the structure of readiness of future specialists for independent work. That is why they focused in the study on the readiness of future physical culture specialists and sports to the independent organization of the educational and training process. This process will be successful only when it has the following structural components: motivational, cognitive, activity, reflective (Fig. 1).

In order to determine the current level of readiness of future specialists to the organization of independent educational and training activities regarding the preservation and restoration of a person's physical and mental health, there was used a number of evaluation methods, which included self-analysis by graduates of the faculty of physical culture and sports of the National University «Yuri Kondratyuk Poltava Polytechnic» (98 students of master's degree in specialty 017 "Physical culture and sports") of their readiness for professional activity regarding the preservation and restoration of a person's physical and mental health; assessment of competent trainers-teachers who work with them. The results of a survey among higher education applicants from specialty 017 "Physical culture and sport" (self-assessment of students and assessment from their teachers) regarding the readiness check of graduate students of the specialty 017 "Physical culture and sport" to the organisation of independent educational and training activities regarding the preservation and restoration of physical and of mental health indicate that the training of future specialists of physical culture and sports at this university is mainly focused on physical culture and health activities, and little attention is paid to independent work regarding preservation and restoration of physical and mental health of a person, including the organization of the educational and training process. Particularly, some

Table 1. Levels of readiness of future physical culture and sports specialists to the independent organization of the educational and training process (in %)

Level	Components				Average rate
	Motivational component	Cognitive component	Action component	Reflective component	
High	20,9 %	31,1 %	19 %	19,9 %	30,3 %
Middle	66,1 %	59,5 %	60,5 %	66,5 %	65,7 %
Low	13,0 %	19,4 %	10,5 %	13,6 %	14,0 %

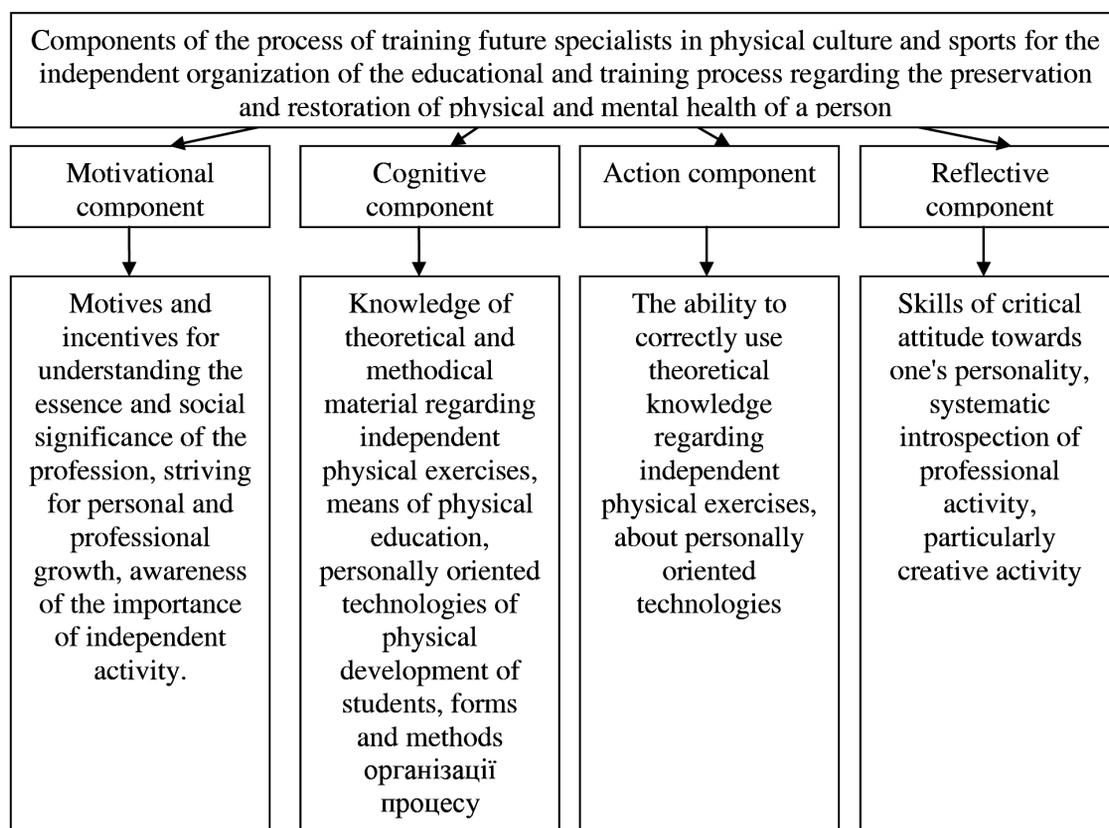


Fig. 1. The structure of the training process for future physical culture and sports specialists to the independent organisation of the educational and training process regarding preserving and restoring a person's physical and mental health

students have not formed a professional pedagogical orientation, motivation to preservation and restoration of physical and mental health, including: a healthy lifestyle, understanding the value of health; observation of the low level of knowledge about the types of educational and training process and methodology of health care. The generalized result of the students' questionnaire about their levels of readiness to organize an independent educational and training process regarding the preservation and restoration of a person's physical and mental health is shown in table 1.

During the experiment, the students of the control group studied according to the educational program "Physical culture and sport" and did not study a special course "Healthcare technologies" (discipline for choice), and, in addition to studying a special course, students of the experimental group attended educational training at the Youth sports school, worked as assistant coaches practically. While holding practical classes with students according to the program of a special course "Health-saving technologies", proper pedagogical conditions were created, in order to receive successful results in preparation for the independent organization of educational and training process of preserving and restoring physical and mental health of a person.

During the formation of students' ability to independently perform physical exercises, they were offered to independently perform only those exercises that were already studied by them in classes in the presence of the

teacher. Students were also recommended to adhere to the principles of systematicity, gradualism, versatility training, in order to achieve significant results in terms of preservation and recovery of physical and mental health. Methods of self-control were also introduced to the students. Special attention was paid to the verification of the performed (planned) training tasks, because it combines independent activity of students together with work in practical classes in a single educational and educational institution process.

During the research, the students were offered, as already mentioned above, to try out the exercises for the educational and training homework direction with an emphasis on the application of health-saving technologies. It has to be mentioned that these exercises were selected by taking into account the multifaceted effect on the body: strengthening the development of large muscle groups, cardiovascular and respiratory systems, development of a general endurance. Some of these exercises increase jumping and running, strength training. For the most part, the exercises are the same for students of all grades, but for high school students, complications are added according to age. Special attention is focused on gradually increasing the load and demandingness of the result of homework that thus contributes improvement of general physical fitness and more successful assimilation for the educational material.

Practice shows that the sooner the teacher-trainer starts training students how to perform physical exercises independently, the more firmly the habit will be established to perform on their own on a daily basis. Only now, that is, after students have developed a need to perform physical exercises, can they be studied in lessons and advised complexes of educational and training classes for students for independent study at home. Thus, in the course of our study, students of experimental groups additionally engaged in sports training (studied complexes training, exercises for physical education breaks and for physical homework culture), and the students of the control group performed only the traditional one curriculum.

During the consulting classes (which were optional), students of both groups could receive recommendations on the method of performing physical exercises and organisation of independent educational training.

During the consultancy stage of the pedagogical experiment, it was found out that the modern system of training students of specialty 017 "Physical culture and sport" in higher education institution is aimed mostly at the formation of skills of organizing physical culture and health activities and little attention is devoted to independent study of students on the organization of the educational and training process regarding the preservation and restoration of physical and mental health. Therefore, during the formative experiment the content of the educational program for the training of future specialists in physical culture and sports has been updated and a special course "Health-saving technologies" has been created. Generalization of the results of the formative stage of the pedagogical experiment made it possible to track the dynamics of structural changes of the components of training future specialists in physical culture and sports to independent organization of the educational and training process regarding the preservation and restoration of a person's physical and mental health. It is established that the indicators of readiness of future physical culture and sports specialists to independent organization of the educational and training process regarding the preservation and restoration of physical and mental health in the experimental group is higher than in the control one. The data of the experimental study were confirmed the effectiveness of the developed model of the organization of independent educational and training activities regarding the preservation and restoration of physical and mental health of a person in future physical culture and sport specialists. Furthermore, the process of independent organization of educational and training activities for future specialists in physical culture and sports is essential and expedient in a training system. After all, modern society needs competent specialists of physical culture and sports, which is explained by:

- firstly, the deterioration of the health of the population, in particular the health of students and student youth;
- secondly, the presence of hypo-dynamics in the population and a sedentary lifestyle;
- thirdly, the need to expand services from a range of measures of a sports and health nature, aimed at general physical conditions improvement of wide sector

of the population, who are interested in the formation and strengthening their health and physical conditions;

- fourthly, the need to involve young people in sports and healthy lifestyle, expanding the scope of services for the population in terms of health-preserving technologies usage for the purpose of intensification of motor activity and health and recreational activities for the actualization of a healthy lifestyle, and therefore, the formation of strengthening and preservation of human health.

When preparing physical culture and sports specialists for an independent organization of the educational and training process, it requires a high level of professional mobility and competence that can be achieved at the expense of principle update of all aspects of the educational process at higher education institutions. One of the methodological approaches, which allows rethinking the current state of education and identifying ways of its modernization is an innovative activity.

DISCUSSION

Certain aspects are revealed in national and foreign scientific literature, including problems of maintaining and restoring physical and mental health of a person by means of physical exercises, in particular: conceptual, substantive and procedural aspects of improving the quality and efficiency of the educational and training process in modern conditions of sports schools [1]; educational and training classes to restore physical health [2, 3]; conditions quality training of athletes to improve their health [4]. Issues of control, planning and modelling of the training process in aspects of overcoming psychological stress and anxiety are devoted to the work of Rybalko L., Onishchuk L. [5]. The analysis and generalization of literary sources proves that the least issues related to the preparation of future ones remain to be investigated physical culture and sports specialists to preserve and restore physical and mental health of a person. High-quality training of future specialists in physical culture and sports in relation to preserving and restoring of a person's physical and mental health ensures an increase in motor activity, rational carrying out of active activities leisure time and, as a result, education of the need to systematically engage physical culture and health activities and have the ability and skills to organize educational and training process among pupils and student youth with an aim of to preserving and restoring physical and mental health. Despite numerous theoretical and methodological studies by scientists, problems of training future specialists to organize independent work and educational and training process in order to preserve and restore the physical and mental health is currently insufficiently developed.

Question of a professional training of physical culture and sports specialists is disclosed in the works of national and foreign researchers. In particular, the peculiarities of the professional activity of a physical education teacher was considered by Samodryn A. [6]; formation of students' interest in the profession "teacher of physical education culture" – Subbota Yu [7]; the formation of a professional pedagogical orientation of students of the faculties of physical education

illuminated – Cushchenko L. [8]; motives and incentives for learning faculties of physical education – Vyshnevetska V. [9].

During the study, scientific goals regarding the impact of educational and training process from physical culture and sports to physical and mental health of a person in the aspect of his preservation and restoration were achieved. The results of the scientific research are original.

CONCLUSIONS

All things considered, for the effective training of future physical culture and sports specialists it is

essential to create an independent organization of the educational and training process regarding preserving and restoring a person's physical and mental health and to build the educational process according to the developed model in the conditions of the introduction of interactive learning that opens new horizons due to ensuring a high pace of learning, time saving, and most importantly - digitalization through mobile devices which allows students to be remotely taught (useful for those, who are unable to attend classes because of training or competitive activities).

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 15.05.2023

ACCEPTED: 20.10.2023



*Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

STUDY OF THE IMPACT OF ELECTRONIC LEARNING TOOLS ON THE LEVEL OF FORMATION OF HEALTH-PRESERVING COMPETENCE AMONG STUDENTS OF THE SPECIALTY «THERAPY AND REHABILITATION»

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ABSTRACT

Aim: To check the effectiveness of the health-preserving competence formation in future specialists with the processing of multidimensional data using electronic learning tools when studying the discipline «Basics of the theory of health and a healthy lifestyle».

Materials and Methods: The research was conducted during the 2022-2023 academic year on the basis of the «Kharkiv Humanitarian and Pedagogical Academy» a communal institution of the Kharkiv Regional Council, Poltava State Medical University and Luhansk Taras Shevchenko National University. 120 students of the specialty 227 «Therapy and Rehabilitation» and 017 «Physical Culture and Sports» were involved in the pedagogical experiment. Research methods: analysis of scientific and methodical literature; pedagogical observation; pedagogical experiment; pedagogical testing; methods of mathematical statistics.

Results: The technology of performing practical competence-oriented tasks and the system of its evaluation, which provided for the diagnosis of the activity component of competence, were substantiated. Test tasks for diagnosing the cognitive component of competence and a special method of processing the results have been developed, which ensures the integration of relevant indicators of individual components of competence into the final generalized result.

Conclusions: The diagnostics of the development levels of the formation of the health-preserving components of multidimensional data processing competence among future specialists, the statistical processing of the obtained data at all stages of experimental work, made it possible to make a statistically reliable conclusion about the positive impact of the implemented model of the formation of the studied health-preserving competence by means of electronic learning.

KEY WORDS: health-preservation, competence, model, rehabilitation, higher education students, therapy

INTRODUCTION

Among pedagogical technologies, new information technologies with an aspect of health-preserving competence have become widespread in institutions of higher education. There is no doubt about the necessity of their implementation in the educational process, since information technologies are one of the most important means of raising the intellectual level of a person, and qualitatively improving the training of future specialists. Usage of information technologies stimulates motivation, increases cognitive interest, and the effectiveness of learning. Information technologies of education open fundamentally new opportunities in educational activity and creativity of the student of education [1-3].

Computer systems for educational purposes provide an opportunity to differentiate the learning process,

apply an individual approach, monitor the personality and provide feedback, to ensure self-control and self-correction of educational and cognitive activity; to reduce learning time by performing complex calculations by the computer [4-10]. A careful analysis of the scientific and methodological literature on the problem of the use of informational means of learning by students of higher education indicates the presence of various computer software products of an educational and controlling nature. But at the same time, we discovered that not enough attention is given to informatization of the process of assimilation of multivariate analysis methods [11-14]. This prompted the authors to determine the influence of electronic learning tools on the level of formation of health-preserving competence among students of higher

education specialty 227 «Therapy and Rehabilitation» and 017 «Physical Culture and Sports» [15-20].

The transition to competence-oriented content of education requires a thorough system of evaluation of the final result of education, determination of the level of competence formation. Currently, a clear, unified methodology for diagnosing health-preserving competence has not been developed. Traditional methods of monitoring knowledge and skills do not allow to fully diagnose the level of health-preserving competence formation, which is why there is a need for a comprehensive approach to solving this task.

AIM

The aim of the study is to check the effectiveness of the model health-preserving competence formation in future specialists with the processing of multidimensional data using electronic learning tools when studying the discipline «Basics of the theory of health and a healthy lifestyle».

MATERIALS AND METHODS

The research was conducted during the 2022–2023 academic year on the basis of the «Kharkiv Humanitarian and Pedagogical Academy» a communal institution of the Kharkiv Regional Council, Poltava State Medical University and Luhansk Taras Shevchenko National University. 120 students of the specialty 227 «Therapy and Rehabilitation» and 017 «Physical Culture and Sports» were involved in the pedagogical experiment. In accordance with the set task, in order to determine the effectiveness of the model of competence formation among future specialists in the processing of empirical data, a pedagogical experiment was conducted, which consisted of two stages: ascertainment-research (September-December 2022) and formative (January-May 2023).

At the first stage of the experiment, an analysis of the scientific and methodological literature on the research problem was carried out; existing requirements for informational training of students of higher education, experience in using electronic learning tools; the level of residual knowledge of education seekers regarding the basic concepts of data processing was determined, a questionnaire was conducted, the directions and tasks of the next stage of the pedagogical experiment were outlined.

At the beginning of the 2022-2023 academic year, in order to diagnose the current level of basic knowledge of informatics in data processing among students, a testing method was chosen and a special system of test tasks was developed. The corresponding test contained general information on the basic concepts of data processing, in the following directions: 1) information and information processes; 2) modeling; 3) information technologies; 4) informational system; 5) problem solving technology using information and communication technologies tools; 6) algorithmization. Entrance testing was conducted at the first information technology class in a computerized form. Exactly 120 students of the specialty 227 «Therapy

and Rehabilitation» and 017 «Physical Culture and Sports» took part in the testing.

At the formative stage of the experiment, representative samples of students of the control (CG) and experimental (EG) groups were formed, and model of health-preserving competence formation of higher education seekers using multidimensional data analysis methods in therapy and rehabilitation with the use of electronic learning tools was tested. The main methods of research at this stage were: pedagogical experiment, questionnaires, testing, statistical methods of processing research results. In accordance with the tasks of the research, the following algorithm was created: formation of representative samples of students of master's degree from CG and EG; organization of the training process for students from EG in accordance with the developed model of health-preserving competence formation in the processing of multidimensional data with the use of electronic learning tools; experimental verification of the effectiveness of the developed model for the formation of health-preserving competence in processing multidimensional data.

In order to form a representative sample of students of CG and EG before the start of the experimental work, we determined the following indicators: input control of knowledge available to students regarding the study of experimental data processing. To conduct a pedagogical experiment, students of higher education divided into two groups of 50 people each. Before the start of the experiment, the hypothesis regarding the law of the distribution of random variables was tested and a criterion was selected for testing the hypotheses regarding the parameters of this distribution. Due to the fact that the studied variables in the experiment are subject to a normal distribution, the Student's t-test was used [4, 5, 21].

At different stages we have used such *set of research methods*:

- *theoretical* – methods of conceptual and comparative analysis, which compared the existing theoretical approaches on the basis of generalization of philosophical, methodological, psychological, pedagogical, educational literature and video materials; method of structural-system analysis and modeling;
- *empirical* – methods of collecting information (questionnaires, surveys, pedagogical testing), analysis of learning outcomes, interviews, methods of expert assessment, self-assessment, generalization of independent characteristics; ascertaining, formative, and control stages of pedagogical experiment, methods of clarity;
- *methods of statistical data processing* – for processing experimental data, their quantitative and qualitative analysis. They were used to identify the reliability of the difference between the studied indicators, the correct processing of the results, reflecting them in graphical and tabular forms, conducting experimental testing; descriptive statistics, determination of the statistical significance of differences between groups by correlation analysis.

We used the Student's criterion to determine whether there are statistically significant differences between the residual knowledge from the previous study of discipline «Basics of the theory of health and a healthy lifestyle» by students from CG and EG. The null hypothesis H_0 was formulated as follows: there are no significant differences in the existing knowledge of informatics in CG and EG before the start of the experiment. It turned out that the empirical value of the t-criterion (0.57) is less than the critical value (2.01). Thus, we concluded that there were no significant differences in the residual knowledge among students from CG and EG before the start of the experiment at the significance level of 0.05.

The Ethics Commission of the Luhansk Taras Shevchenko National University has no comments on the methods used in this study.

RESULTS

The conducted survey also makes it possible to draw a conclusion about the homogeneity of EG and CG. The analysis of the obtained data during the evaluation by the students of CG and EG education of their own abilities to use general purpose programs allows us to state: 16.0% of CG education students indicated that they know how to work perfectly; 36.0% are able to perform basic actions confidently; 32.0% have difficulties; 12.0% do not know how to work at all. Students of EG education indicated that they know how to work perfectly – 20.0%; are able to perform basic actions confidently – 32.0%; have difficulties – 36.0%; do not know how to work at all – 12.0% of respondents (Fig. 1).

The results are almost the same when students self-assess their desire to learn methods of processing multidimensional data before the experiment. Current interest was recorded in 52.5% of students of CG education and 53.8% of students of EG education (Fig. 2).

Based on the analysis of the results of the input control of the residual knowledge in the study of the discipline

«Basics of the theory of health and a healthy lifestyle» and questionnaires, it can be stated that there were no differences in the students of CG and EG before the experimental work. This approach allows us to consider the CG sample identical to the EG sample at the corresponding stage of the experiment with a confidence level of 0.95.

The developed computer training and control program was used during classroom and independent classes with students of the specialty 227 «Therapy and Rehabilitation» and 017 «Physical Culture and Sports» EG in the discipline «Basics of the theory of health and a healthy lifestyle». Teachers used the developed program to demonstrate theoretical material in lectures, when conducting practical classes for students to master practical skills in working with professional statistical packages, to organize their independent work and to control the cognitive component of the formed competence in multidimensional data analysis methods. Indicators of the levels of competence formation of students in the processing of multidimensional data according to the developed criteria for EG and CG are given in the Table 1.

Most of the students from EG education (64.0%) demonstrated a sufficient or high level of competence in processing multidimensional data, and from CG respectively – 24.0%. A comparative analysis of the obtained results regarding the formation of competence of students of CG and EG education is presented in Fig. 3.

The formation of the studied competence had highest value at a satisfactory level for students from EG education, and at medium level for students from CG education (Table 2).

It should be noted that the formation of the investigated competence in processing multidimensional data, depending on its components, among students of EG education has the greatest value at a satisfactory level, and in CG greatest value is at medium level. Table 3 presents knowledge and activity data.

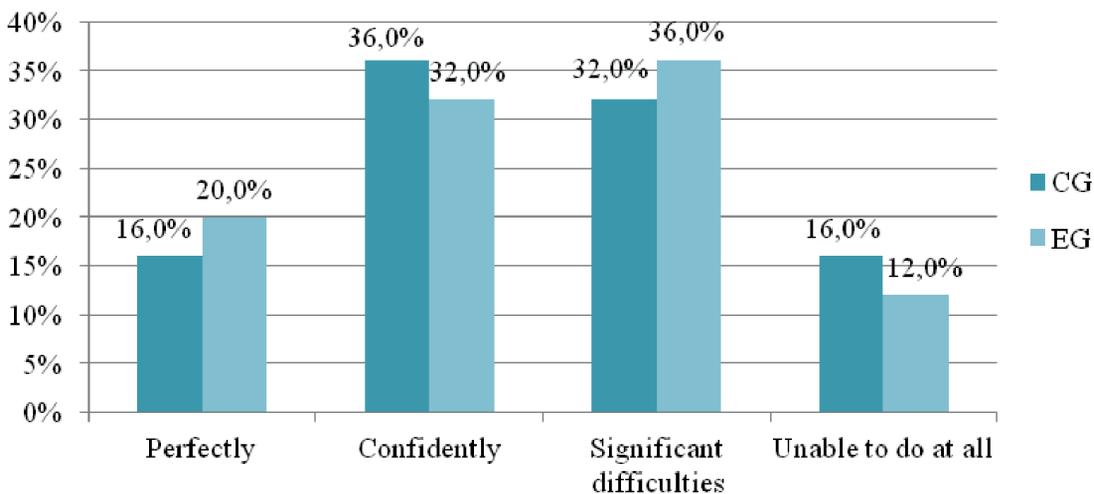


Fig. 1. Assessment by students of higher education of CG and EG of their own level of ability to use general-purpose programs

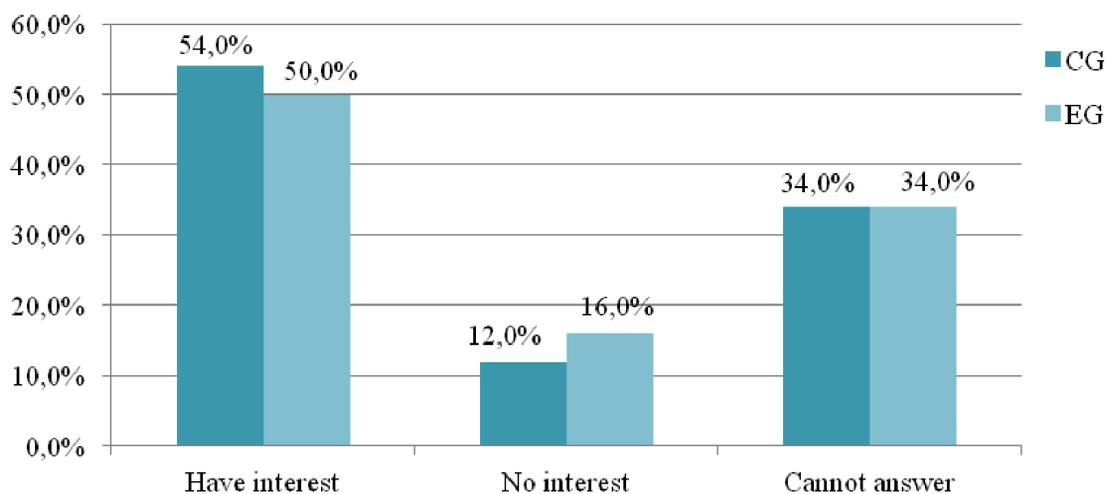


Fig. 2. Self-assessment by students of CG and EG education of the desire to learn methods of processing multidimensional data

Table 1. Indicators of the formation of competence in multidimensional data processing among students of CG and EG after the experiment

Level	Rating scale	Control group		Experimental group	
		Number of students	%	Number of students	%
Unsatisfactory	(0%-20%)	1	4.0	1	4.0
Low	(20%-40 %)	5	20.0	1	4.0
Medium	(40%-60 %)	13	52.0	7	28.0
Satisfactory	(60%-80%)	5	20.0	12	48.0
High	(80%-100%)	1	4.0	4	16.0
Total		25	100	25	100

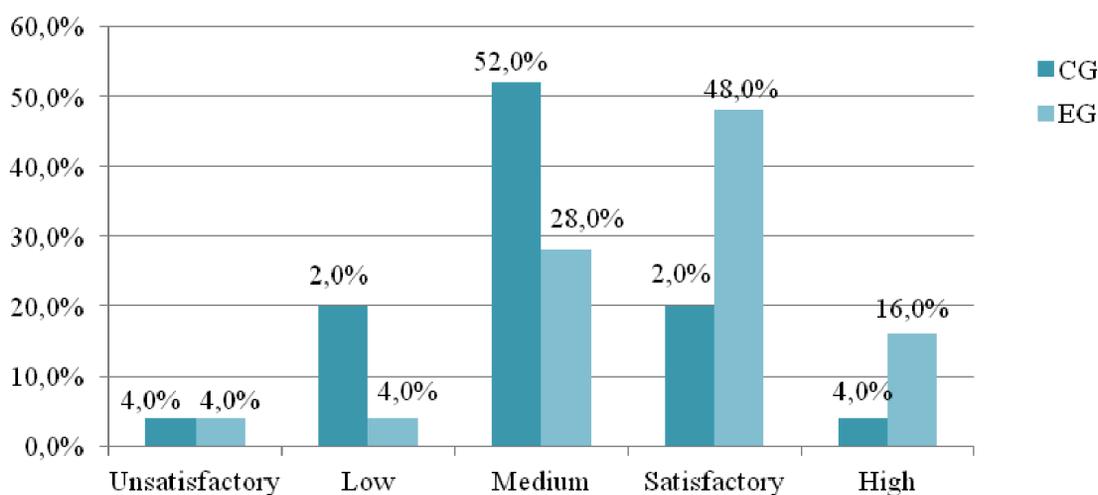


Fig. 3. Indicators of levels of competence formation in processing multidimensional data of students from CG and EG

Table 2. Indicators of the formation of competence in multidimensional data processing among students of CG and EG according to the established criteria after the experiment

Component of competence	Level	CG (%)	EG (%)
Cognitive (knowledge)	Unsatisfactory	4.0	4.0
	Low	20.0	4.0
	Medium	52.0	32.0
	Satisfactory	20.0	50.0
	High	4.0	10.0
Active	Unsatisfactory	4.0	4.0
	Low	20.0	4.0
	Medium	56.0	30.0
	Satisfactory	16.0	50.0
	High	4.0	12.0

Table 3. The percentage of components of competence with the processing of multidimensional data at a satisfactory and high level in students from CG and EG after the experiment

Component of competence	Level	CG (%)	EG (%)
Cognitive	Satisfactory	20.0	50.0
	High	4.0	10.0
Action	Satisfactory	16.0	50.0
	High	4.0	12.0

The results show that the percentage of students of EG education, in whom the formation of the cognitive component of competence at satisfactory and high levels, was 60%, and in CG – only 24%. As for the activity component, the advantage of EG over CG is even greater – 62% versus 24% ($p < 0.01$).

A comparison of the results obtained in the pedagogical experiment, their quantitative and qualitative analysis revealed that the developed model of health-preserving competence formation for processing multidimensional data in the learning process led to statistically significant changes in the levels of formation of the investigated competence. We can assert that there were differences in the levels of competence formation with the processing of multidimensional data between CG and EG with a significance level of $p = 0.01$.

This makes it possible to conclude that the obtained results regarding the formation of competence in the processing of multidimensional data in EG are the result of the complex implementation of the developed model using electronic learning tools, which ensures the effective formation of the investigated competence. In order to identify future specialists' motivation and personal interest in studying methods of processing multidimensional data with the help of ICT after a pedagogical experiment, a questionnaire was proposed.

The results of the survey showed that the expression of interest in learning methods of processing empirical data after the experiment was significantly higher in EG compared

to CG (88.0% and 40.0%, respectively) (Fig. 4). It is worth noting that only one EG student indicated that he had no interest in learning data processing methods compared to CG, in which 24.0% of students gave the answer «no» (Fig. 4).

When answering the question «Did you strive to achieve a high level of competence in the processing of medical and biological data?», 92.0% of the EG students answered «yes», compared to 60.0% of the CG's students. It is worth noting that only one student of EG education gave the answer «no», in contrast to 16.0% of CG (Fig. 5).

When assessing their own level of competence in processing multidimensional data, students of EG education mostly chose a high or satisfactory level (32.0% and 56.0%, respectively). CG education seekers most often chose a satisfactory or medium level of formation of the studied competence (40.0% and 48.0%, respectively) (Fig. 6).

When evaluating their own level of computer skills after the experiment, 60.0% of EGs chose the «satisfactory» category, which is 36.0% more than CG. It is worth noting that not a single student of CG and EG education indicated that they did not know how to use computer equipment after the experiment. The «minimum skills» category was chosen by 24.0% of CG students, compared to 4.0% of EG students. The «specialist» category was chosen by 12.0% of EG, in contrast to 4.0% of CG (Fig. 7).

The analysis of the results obtained in the assessment by the students of their own skills in using text editors, electronic spreadsheets, database management systems,

programs for preparing presentations and working on the Internet after the experiment allows us to state that positive dynamics were observed in both groups, but the results of EG were higher. When students of EG education assessed their own ability to use general-purpose programs, 68.0% chose the «perfectly» category, which is 44.0% more than CG (Fig. 8). Not a single EG master's student indicated that they do not know how to use general-purpose programs, in contrast to 4.0% of CG.

The results of CG students' evaluation of their own skills in using general-purpose programs before and after the experiment showed that the most often the education seekers chose the «confident» category – 42.0%, which is 14.0% more than the results before the experiment (Fig. 9).

DISCUSSION

The diagnostics of the development levels of the formation of the components of multidimensional data processing

competence among future specialists, the statistical processing of the obtained data at all stages of experimental work, made it possible to make a statistically reliable conclusion about the positive impact of the implemented model of the formation of the studied competence by means of electronic learning [2-8]. The results of the study confirmed that the developed model ensures the creation of a favorable educational environment for the formation of competence in future specialists with the processing of multidimensional data in the process of studying the discipline [14-17].

In the process of studying the discipline «Basics of the theory of health and a healthy lifestyle» a certain level of competence in processing empirical data in a multidimensional space is formed in the students, which can be evaluated based on the results of specially organized calculation and graphic work of competence orientation and computerized test control. The technology of performing

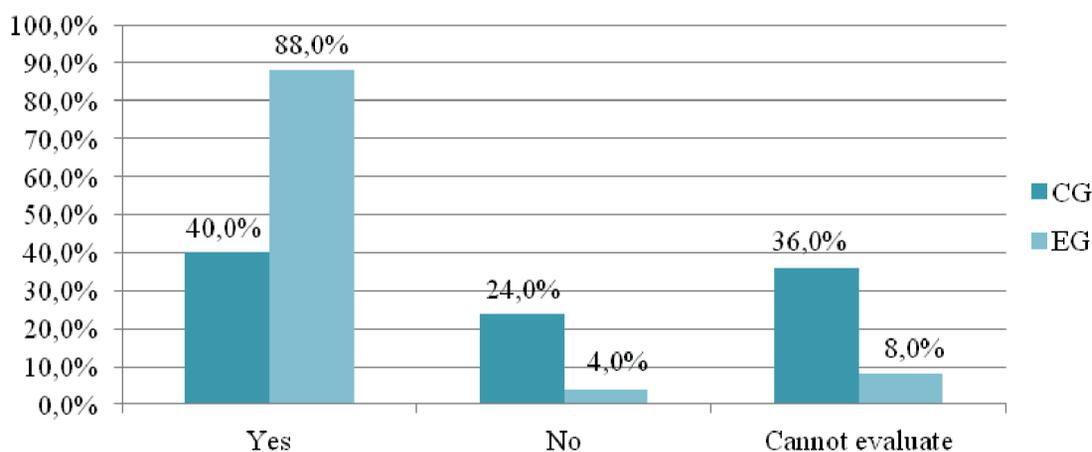


Fig. 4. Self-assessment of interest in learning methods of processing multidimensional data by students from CG and EG

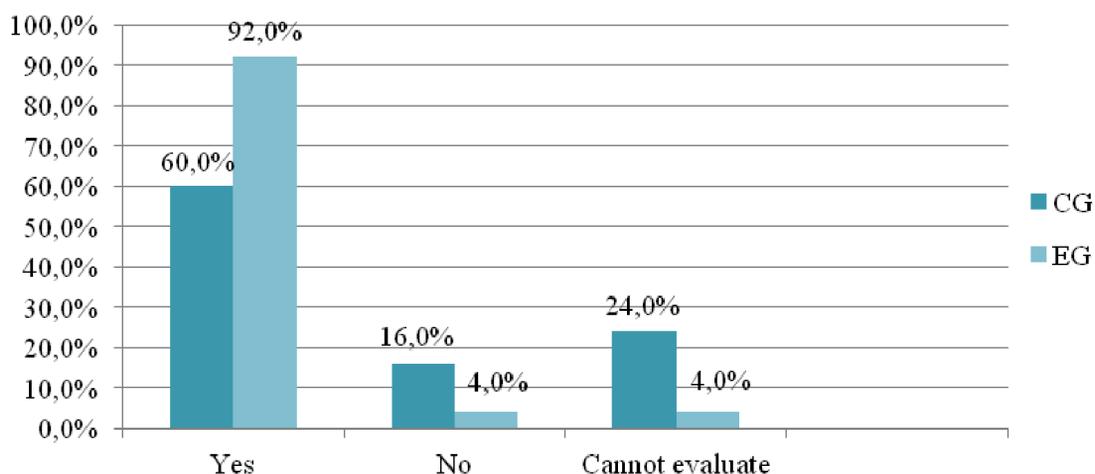


Fig. 5. Self-assessment of the desire to achieve a high level of competence with the processing of multidimensional data by students from CG and EG

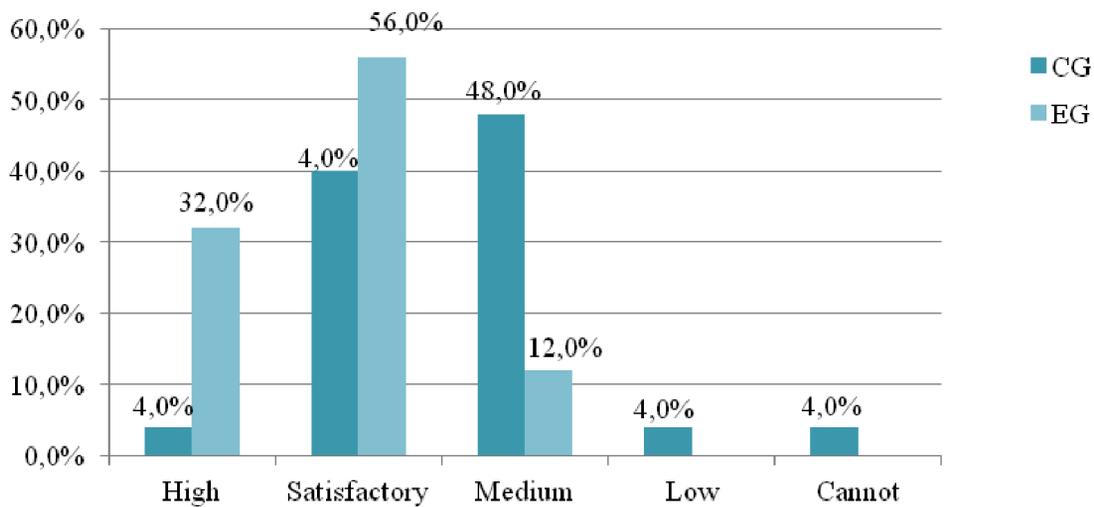


Fig. 6. Evaluation by students from CG and EG of their own level of competence formation with the processing of experimental data

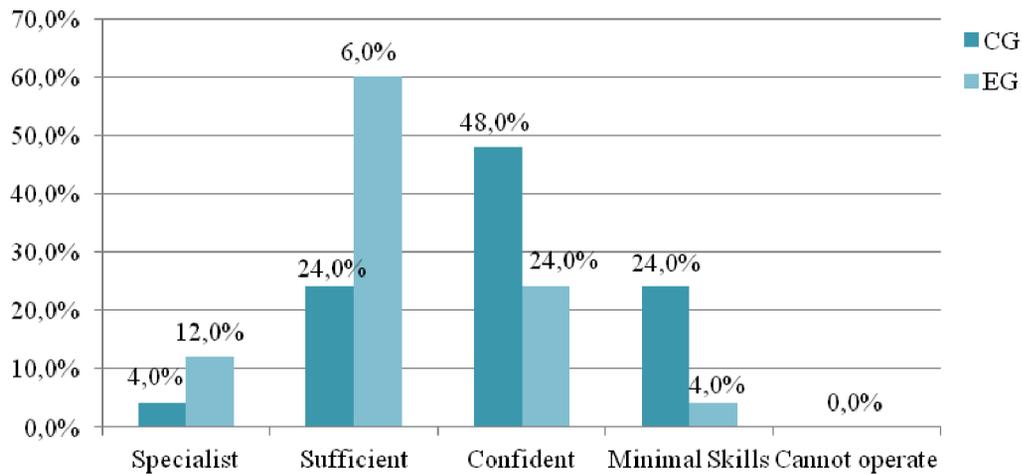


Fig. 7. Assessment by students from CG and EG of their own level of ability to use computer equipment after the experiment

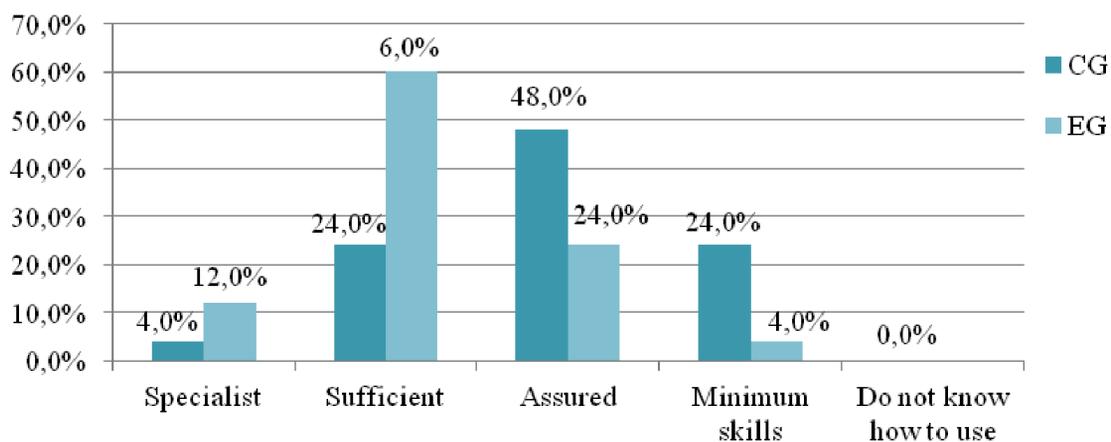


Fig. 8. Evaluation by students from EG of their own skills in using general-purpose programs before and after the experiment

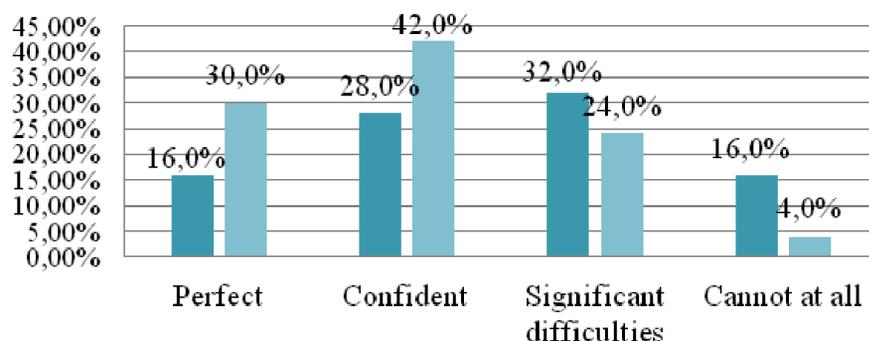


Fig. 9. Assessment by students from CG of their own skills in using general-purpose programs before and after the experiment

practical competence-oriented tasks and the system of its evaluation, which provided for the diagnosis of the activity component of competence, were substantiated. Test tasks for diagnosing the cognitive component of competence and a special method of processing the results have been developed, which ensures the integration of relevant indicators of individual components of competence into the final generalized result [18-21].

The results of the questionnaire at the final stage of the pedagogical experiment showed that all students (100%) of the EG assessed the ability to process multidimensional data as important for the professional activity of future therapy and rehabilitation specialists and indicated that they sought to achieve a high level of the studied competence. In CG, only 68.0% of respondents rated the relevant skills

as important; 62.0% of the respondents sought to achieve a high level of the investigated competence.

CONCLUSIONS

The experimental study confirmed the effectiveness of the developed model of health-preserving competence formation in future specialists with the processing of multidimensional data and the methodology of its implementation in the process of teaching the discipline. The analysis of the obtained results allows us to state that the main goal of the study – the verification of the effectiveness of the model of health-preserving competence formation in future specialists with the processing of multidimensional data using electronic learning tools in the study of the discipline has been achieved.

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The article was written in accordance with the topics of the research works «Perspective directions of improving the quality of professional training of specialists in physical culture and sports» (state registration number 0117U005556) of the Department of Theory and Methods of Physical Education of Luhansk Taras Shevchenko National University and «Theoretical and methodological aspects of health-preserving technologies and increasing the level of physical fitness by means of physical education in the process of professional training of students of higher education institutions» (state registration number: 0120U100561) of the Department of Physical and Rehabilitation Medicine of Poltava State Medical University. Research was financed by authors.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 19.07.2023

ACCEPTED: 05.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

CHANGES IN BODY COMPOSITION AFTER INDOOR CLIMBING PROGRAM IN ADULTS WITH INTELLECTUAL DISABILITIES

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ABSTRACT

Aim: Overweight and obesity are also among the biggest health problems for people with intellectual disabilities. Rehabilitation programmes often use various sports disciplines. The aim of the study was to evaluate the effect of indoor climbing on the body weight and adipose tissue levels in people with mild and moderate intellectual disability.

Material and Methods: The study involved 68 people aged 18-25 with a diagnosed intellectual disability with a total IQ of 38-69. The experimental group took part in organised climbing activities twice a week for 15 weeks. Before and after the programme, body height and weight, the percentage of body fat and the circumferences of the forearm and lower leg were measured. The body mass index (BMI) was also calculated.

Results: There was a significant increase in body weight and BMI in both groups; this was greater in the control group. Only in the control group was a significant increase in the adipose tissue as a percentage of body weight observed, while in the experimental group there was a slight decrease in this parameter. In the experimental group, a slight increase in the circumferences of the lower leg and forearm was observed, while in the control group there was a decrease.

Conclusions: The study shows that climbing classes may lead to beneficial changes in the body composition of people with intellectual disabilities. Climbing can be included in programmes promoting physical activity in this group and become part of the prevention of lifestyle diseases such as overweight and obesity.

KEY WORDS: overweight, obesity, developmental disability, physical activity

INTRODUCTION

Intellectual disability (ID) is a very heterogeneous group of disorders with different clinical pictures. The most significant features of people with ID are significantly limited intellectual activity and adaptive behaviour, manifested in cognitive, social and practical skills [1-3]. However, the literature also emphasises the fact that people with ID are characterised by a much worse health condition than the population of people with a normal intelligence quotient (IQ).

Lifestyle diseases are among the biggest health problems in highly developed countries. In addition to cardiovascular diseases, hypertension, cancer and diabetes, this group of diseases undoubtedly includes obesity. Nowadays, obesity is a worldwide disease that occurs regardless of age and gender, particularly often in people with disabilities, including ID [4-7].

Research shows that the problem of overweight and obesity may affect up to 41% of teenagers attending Spanish special schools [8]. The body weights of 33.6% of adults with ID in the United States (US) and 27% in the United Kingdom are also above the norm [5]. Moreover, the prevalence of obesity among adolescents with ID in the US is almost twice as high as in the general population [6]. Data from Australia also indicate a higher prevalence of overweight

and obesity in adolescents with ID compared to their peers in the intellectual norm [7]. The current situation caused by the coronavirus pandemic, the associated isolation and a significant reduction in physical activity are particularly worrying. According to experts, this contributes to an additional intensification of the problem in individual social groups [9, 10].

There is no doubt that obesity is one of the factors that limits efficient functioning in the environment and undeniably has an impact on human health. The high prevalence of obesity in people with ID indicates the need for effective interventions aimed at changes in body weight and composition. These interventions primarily focus on lifestyle changes in terms of diet, health education, cognitive-behavioural strategies and physical activity [11-13]. It is well known that physical activity, including exercise and sport, has vast benefits for physical and mental health and is of great importance in maintaining a healthy body weight. Unfortunately, people with ID are characterised by a low level of activity and a sedentary lifestyle. Only a small percentage of them meet the guidelines for the recommended standards of physical effort necessary for health [11, 12].

When choosing exercise programmes for people with ID, not only the general recommendations for physical

activity should be taken into account, but also the specific needs of these people. Without additional support and encouragement, they become easily discouraged and quit exercising. Therefore, interesting and pleasurable programmes are particularly desirable [13,14]. In addition to general strength and aerobic exercises, programmes dedicated to people with ID use specific sports disciplines, such as basketball, athletics, dancing, gymnastics, jogging or swimming [13-16]. Sport climbing is becoming more and more popular, including for people with disabilities. Due to its comprehensive effect on the body, it is being used more and more often in the treatment of various diseases and disorders [17]. Despite the lack of scientific evidence, its usefulness is also considered in the promotion of physical activity in young people and in the prevention of lifestyle diseases such as overweight and obesity [18,19]. The literature provides information on the positive effect of climbing training on body composition and fat reduction [19-21]. However, all these studies concern healthy people and, to our knowledge, there is no information about the possibility of using climbing programmes in the prevention and reduction of overweight and obesity in people with ID. Given the scale of the problem in this group, any initiatives in this regard are desirable. Considering the high popularity of climbing, including for people with disabilities, and with the frequent creation of more facilities providing easier access, climbing programmes may become part of the therapy for people with ID. Hence, the aim of this study was to assess the impact of a climbing programme on the body weight and body fat of people with mild and moderate ID.

MATERIALS AND METHODS

In total, 73 people aged 18-25 with mild or moderate ID with a total IQ of 38-69 were qualified to participate in the study. People with medical contraindications for participating in sports activities and those with class II obesity were excluded from the study due to the potential low-training volume. All persons qualified for the project lived with their guardians on a daily basis and took part in organised educational activities during the week (about six hours a day). During the project, none of the qualified persons participated in any other systematic sports activities. The respondents expressed their willingness to participate in the project. The consent of their legal guardians and the consent of the bioethics committee to conduct the study were also obtained. All procedures were carried out in accordance with the principles of the Declaration of Helsinki.

The qualified people were randomly divided into two groups: experimental (37 people) and control (36 people). During the project, five people from the experimental group had to resign from participation for independent reasons and their results were not taken into account. Ultimately, the experimental group included 13 women and 19 men. In the control group, there were eight women and 28 men. In each of the groups, 22 people were diagnosed with moderate ID. Additionally, there were 14 people

with mild disabilities in the control group and ten in the experimental group. The mean age in the control group was 20.8 years, while in the experimental group it was one year higher.

Measurements were performed twice on each person participating in the project, immediately before and after the end of the programme.

Body height was measured with a Martin-type anthropometer. Measurements were performed under standard conditions, in an upright posture without shoes. Body weight and the percentage of adipose tissue were measured in light clothes, without shoes, on a Tanita BF-350 scale using the phenomenon of electrical bioimpedance, with an accuracy of 0.1 kg. Based on the data on body height and weight, the BMI was calculated.

The circumferences of the forearm and lower leg were also measured using a centimetre tape with an accuracy of 0.1 cm. The circumference of the forearm was measured at the widest point, slightly below the elbow joint, with relaxed muscles, the arm straightened and freely lowered, and the wrist relaxed and straightened. The circumference of the lower leg was measured where the calf muscles were most developed, with the muscles relaxed.

STATISTICAL ANALYSIS

Statistical analysis was carried out with Statistica 13 software. Basic and descriptive statistics were used: the mean and standard deviation. The normality of the distribution of variables was assessed with the Shapiro-Wilk test and the homogeneity of the variance with the F test. The significance of the differences between the experimental and control groups was estimated using the t-test for independent samples or the Mann-Whitney U test, while differences between the measurements were estimated using the t-test for dependent samples or the Wilcoxon test. The level of significance was accepted at 0.05.

INTERVENTION

The training programme lasted 15 weeks. During this time, people from the experimental group took part in organised activities in a sports hall with a professional climbing wall twice a week. Each class lasted 60 minutes and consisted of a ten-minute general development warm-up, the main part devoted to climbing, and a final part of five minutes. The parameters of the wall and the variety of formations and grips allowed the difficulty of the climbing routes to be individually matched to each participant. This also made it possible to increase the difficulty of routes as the skills increased. The participants climbed primarily belayed from the top, covered traverses of various difficulty levels, and also had the opportunity to learn about individual climbing competitions. In order to ensure the maximum intensity of classes, the participants were divided into smaller groups. Each group was guided by a climbing instructor and could also count on the help of volunteers trained in belaying.

RESULTS

The mean body height in the control group was 170 cm, which was 5 cm more than in the experimental group.

Table 1. Basic somatic features of the body structure in participants from the experimental and control group

VARIABLE	PRE MEAN ± SD		POST MEAN ± SD		Between measurements comparison p
	E	C	E	C	
Height [m]	1,65±0,09	1,70±0,08	1,65±0,09	1,70±0,08	E 0,06
Between group comparison p	0,008*		0,009*		C 0,13
Body weight [kg]	61,87±12,86	67,10±11,80	62,76±12,53	68,32±12,41	E 0,001*
Between group comparison p	0,094		0,073		C 0,007*
BMI [kg/ m ²]	22,73±3,98	23,11±3,84	22,99±3,78	23,47±3,85	E 0,005*
Between group comparison p	0,69		0,60		C 0,01*
Fat tissue [%]	16,97±8,09	16,96±8,75	16,86±7,82	17,82±8,60	E 0,66
Between group comparison p	0,946		0,644		C 0,03*

E-experimental group, C-control group, SD – standard deviation, * statistically significant differences

Table 2. Body weight status of participants from the experimental and control group

VARIABLE	PRE MEAN ± SD		POST MEAN ± SD	
	E (n=32)	C (n=36)	E (n=32)	C (n=36)
Underweight	6,3%	6,3%	5,6%	5,6%
Normal body weight	71,9%	71,9%	61,1%	58,3%
Overweight	15,6%	15,6%	30,6%	30,6%
Obesity I degree	6,3%	6,3%	2,8%	5,6%

E-experimental group, C-control group, SD – standard deviation, * statistically significant differences

Table 3. Circumference measurements of participants' forearms and lower legs before and after 15 weeks of climbing classes

VARIABLE	PRE MEAN ± SD		POST MEAN ± SD		Between measurements comparison p
	E	C	E	C	
Circumference of the left forearm [cm]	24,66±2,40	25,47±2,13	24,73±2,64	24,86±2,27	E 0,79
Between group comparison p	0,15		0,82		C 0,0003*
Circumference of the right forearm [cm]	24,86±2,36	25,50±2,24	24,92±2,73	24,97±2,35	E 0,82
Between group comparison p	0,26		0,93		C 0,0009*
Circumference of the left lower leg [cm]	35,02±3,52	36,29±3,21	35,09±3,31	36,05±3,37	E 0,70
Between group comparison p	0,12		0,24		C 0,08
Circumference of the right lower leg [cm]	35,09±3,37	36,53±2,96	35,12±3,18	36,33±3,18	E 0,95
Between group comparison p	0,10		0,27		C 0,18

E-experimental group, C-control group, SD – standard deviation, * statistically significant differences

In both the first and the second round of measurements, the groups did not differ significantly in terms of body weight and BMI. The reported intergroup differences in mean body weight values in the first round of measurements were 5.23 kg and in the second round of measurements 5.56 kg. The BMIs were 0.35 kg/m² and 0.48 kg/m², respectively. In the second round of measurements, a significant increase in body weight and BMI was observed in both groups. The mean increase in both parameters was greater in the control group. Despite a significant increase in BMI in both groups, a significant increase in the percentage of adipose tissue

was observed only in the control group, while there was a slight decrease in this parameter in the experimental group. The observed discrepancies did not differentiate the studied groups in terms of the percentage of adipose tissue in the second round of measurements, although the difference in mean results in the second round of measurements increased by 0.95% (Table 1).

In the experimental group, the number of people with normal and excess body weight did not change during the project and amounted to 71.9% and 21.9%, respectively. In the control group, the number of people with normal body weight decreased by 2.8%. The number

of people with class I obesity increased by the same amount (Table 2).

When analysing forearm circumferences, no statistically significant intergroup differences were found in the second round of measurements. In the experimental group, a slight increase in circumferences was observed, while in the control group a statistically significant decrease in both limbs was observed. The values of the lower leg circumferences did not differentiate between the groups in the second round of measurements, but there were slight increases in this parameter in the experimental group and decreases in the control group. The observed changes were not statistically significant in any of the groups (Table 3).

DISCUSSION

The aim of the study was to evaluate the effect of a 15-week climbing programme on the body weight and body fat of people with mild and moderate ID.

Men and women with ID are significantly exposed to the development of overweight and obesity, which poses a serious threat to their health.

In this study, despite the exclusion of people with classes II and III obesity, excessive body weight was found in almost 28% of respondents, which confirms this tendency. Studies conducted in various parts of the world show an even larger scale of the problem. Among the Latin American participants at the Special Olympics, overweight was observed in 32.8% and obesity in 11% [4]. The problem of excess body weight also concerned 50.3% of the participants at the Special Olympics from the US and the average BMI value in this group was 31.2 ± 8.1 [22].

The factors that may potentially affect the development of overweight and obesity in people with ID are not only genetic conditions and the inability to correctly diagnose and articulate their nutritional needs, but also their low physical activity [14, 23, 24]. It is well known that regular physical activity is crucial to maintaining a healthy body weight. The effectiveness of sports programmes in this regard for people with ID varies.

After a 12-week training programme conducted five times a week with people with ID aged 13-19 years, Wu et al. observed a significant reduction in body weight, adipose tissue mass and BMI [25]. In a programme comparable in terms of duration, where the respondents trained in basketball, athletics and participated in recreational sports activities, a decrease in body weight and BMI was also noted [15]. Similar changes in body structure were also shown by Wu et al. after a six-month intervention involving dancing, walking, gymnastics and jogging, among others, performed four times a week for 40 minutes [16].

However, after 12 weeks of aerobic exercise, Mendonca et al. did not observe changes in BMI and the percentage of adipose tissue in adults with ID [26]. Older people with mild and moderate disability studied by Schijndel-Speet et al. were also characterised by a similar body weight before and after eight months of intervention based on physical activity (classes three times a week) [27].

It is commonly believed that elite climbers are primarily characterised by a low level of body fat and low body weight, but the results of research in this area are not conclusive [28, 29]. These parameters may be important for the athletic performance of high-level climbers, but body composition is not a barrier to recreational climbing. This is confirmed by this study, which also involved people with overweight and class I obesity. Despite their excessive body weight, they successfully climbed the climbing routes, deriving great joy and satisfaction from this activity. Moreover, after the completed intervention, a slight decrease in the percentage of adipose tissue was observed in the experimental group. Considering that both weight and BMI increased, it can be assumed that there were favourable changes in body composition. Lopera et al. obtained similar results in their project. After a seven-week programme of climbing classes, body weight and BMI increased in the group of students under examination, while the percentage of adipose tissue remained practically unchanged [20]. Similar observations regarding adipose tissue were made by Baláš et al. in children between 10 and 17 years of age who were climbing intensely. It should be noted, however, that this parameter slightly increased in the group who covered fewer metres during classes [21]. In another three-month programme conducted for a comparable age group, Siegel et al. did not show changes in BMI, but there was a slight decrease in the percentage of adipose tissue in the studied group and significant changes in the thickness of the skin fat folds measured on the arm and scapula [18]. The metabolic cost of climbing is assessed on par with moderate and vigorous effort [30]. However, it should be remembered that climbing classes for beginners require many breaks and the climbing time is not that long. It can be assumed that as the skills increase, the benefits of training will also be greater. The limited amount of scientific research in this area does not make it possible to fully evaluate the health benefits in terms of improved body composition resulting from practicing this sports discipline. Despite the lack of convincing evidence, the usefulness of climbing is considered in the promotion of physical activity in young people and for the prevention of lifestyle diseases such as overweight and obesity [18, 19]. This study suggests that similar recommendations may also apply to people with ID.

CONCLUSIONS

Overweight and obesity are common problems of people with ID, and therefore programmes to help maintain optimal body weight are desirable. As climbing is an increasingly accessible and popular discipline, including among people with disabilities, its beneficial health effects are worth considering. The study shows that climbing activities may lead to beneficial changes in the body composition of people with ID. The classes themselves, however, may be insufficient and should be extended to include changing eating habits and behavioural therapy. Future research should focus on the physiological benefits of climbing activities in specific populations and the long-term impact of these activities on body weight composition.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 09.08.2023

ACCEPTED: 28.11.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

APPLICATION OF BALNEOCLIMATOLOGY AND PHYSIOTHERAPY IN ENDOMETRIOSIS

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ABSTRACT

Aim: The purpose of this study is to present physiotherapy and balneotherapy as an adjunct to treatment in reducing pain in women with endometriosis. Accordingly, databases were searched to find the most effective forms of physiotherapy for the treatment of endometriosis.

Materials and Methods: Two independent reviewers have searched medical and public databases such as PubMed, Scopus and PEDro using search terms and MeSH such as endometriosis, pain, physiotherapy, physical activity, balneotherapy, marker miRNA. Subsequently, the data obtained after the queries were then evaluated with regard to the titles in order to remove works with other keywords. The inclusion and exclusion criterion was an article published in a peer-reviewed journal, limited as to the scope of the publication year 2020-2022.

Conclusion: The literature review conducted here suggests that it is necessary to carry out multicentre studies in order to ascertain which forms of physiotherapy and balneotherapy may be most effective in reducing pain and improving the quality of life of women suffering from endometriosis.

KEY WORDS: pain, endometriosis, physiotherapy, balneotherapy

INTRODUCTION

In the general medical sense, feeling pain means simultaneously feeling oneself, finding yourself changed in relation to the world, or more precisely, changed in the context of somatic communication with the world. In other words, the body experiences discomfort as a kind of "disturbance experience." This experience differs from the concept of disease explained from a scientific point of view. Discomfort is not yet a scientific symptom, but a signal generated in the sphere of somatics. This signal is not an object but a shift of meaning between itself and the other symptoms. "Discomfort" is a symbol of dysfunction

or the inability to cope with everyday life. Discomfort is a sign of dysfunction. As such, it is highly evaluative.

Researchers at the Indiana University School of Medicine have identified several specific blood biomarkers that can help to objectively determine the severity of a patient's pain. The biomarkers MFAP3, GNG7, CNTN1, LY9, CCDC144B, and GBP1 have been shown to have the most solid empirical evidence for functional involvement in pain, and therefore can be considered as determinants of pain sensation, which allows clinicians to plan a treatment that can be characterized in a manner that is measurable [1]. The biomarkers identified are not only compatible with specific

pain relievers, but can also help predict whether a patient will suffer from chronic pain in the future [1]. Biomarkers have been found that identify pain independently of gender or diagnosis. It identified those that are better predictors in men and those that are better predictors in women. CNTN1 is associated with chronic pain in women, while LY9 (lymphocyte antigen 9) and MFAP3 are associated with post-traumatic stress disorder (PTSD) in men [1].

Endometriosis is defined as the presence of endometrial tissue outside the uterus. Endometrial implants are most often found in the pelvic peritoneal cavity, on the ovaries, fallopian tubes in the rectovaginal septum, on the urinary bladder and the intestine [2-5]. In very rare cases, there are changes in the diaphragm or lungs [2-5].

This is nowadays one of the most common gynecological diseases, and can affect as much as 10-15% of all women of reproductive age and 70% of women with chronic pelvic pain [2-5].

Although it may affect as many as 176 million women around the world, we still do not know much about the disease and its causes are still being sought [2-4]. Most women with endometriosis report symptoms as early as puberty, and diagnosis is often delayed. Consequently, this delay may reduce their reproductive potential. Moreover, early identification and treatment of endometriosis can alleviate pain, prevent disease progression and organ damage, and preserve fertility [5].

According to the European Association of Urology, endometriosis is categorised under Internal Pelvic Pain Syndromes. The disease is often associated with negative cognitive, behavioural, sexual or emotional consequences, with symptoms that suggest lower urinary tract, sexual, bowel or gynecological dysfunction [6]. Many patients may experience pain above and beyond the endometriotic tissue [6]. Multiple mechanisms have been regarded as the cause of pain in endometriosis: nociception, inflammation and changes in how pain is processed by the peripheral and central nervous systems [7]. In a chronic condition such as endometriosis, the pain from the disease is often associated with psychological stress and fatigue, which can magnify the pain [7]. This has a negative impact on sexual health, becoming a cause of dyspareunia (painful intercourse), which also impacts on relationships between partners.

Dyspareunia is defined as tenderness felt during sexual intercourse without coexisting shrinkage of vulva or vagina. It is a common sexual disorder in women, and can be caused by endometriosis.

Specific microRNA is a potential biomarker of endometriosis [8-11]. Recent studies have shown that microRNAs and their targeted microRNAs have a different expression in women suffering from endometriosis than in healthy women [8-11]. MicroRNA controls a wide spectrum of normal and pathological cellular functions and, according to researchers, may play a key role in the pathogenesis of this disease [8-11]. However, the usefulness of microRNA biomarkers in detecting endometriosis is still uncertain [12], and the search for a biomarker or set of biomarkers remains open.

So far, no optimal way to diagnose endometriosis has been found, nor is there a single effective method for a full recovery. The main symptom influencing the quality of life of women with endometriosis is their perception of pain [13-14] and pharmacological treatment is the dominant treatment in endometriosis, which also aims to reduce pain [15-19]. In justified situations, surgery is the treatment of choice [20-22].

AIM

The purpose of this study is to present physiotherapy and balneotherapy as an adjunct to treatment in reducing pain in women with endometriosis. Accordingly, databases were searched to find the most effective forms of physiotherapy for the treatment of endometriosis.

MATERIALS AND METHODS

In the article, the authors consider the use of physiotherapy as a means of reducing the aspect of pain in endometriosis, and analyze this aspect on the basis of the available literature. Two independent reviewers have searched medical and public databases such as PubMed, Scopus and PEDro using search terms and MeSH such as endometriosis, pain, physiotherapy, physical activity, marker miRNA. Subsequently, the data obtained after the queries were then evaluated with regard to the titles in order to remove works with other keywords.

The inclusion and exclusion criterion was an article published in a peer-reviewed journal, limited as to the scope of the publication year 2020-2022. Another restriction was that it had to be an English-language publication. Failure to meet the inclusion criterion was treated as exclusion from the analysis. A review of journal databases was carried out between September and October 2022.

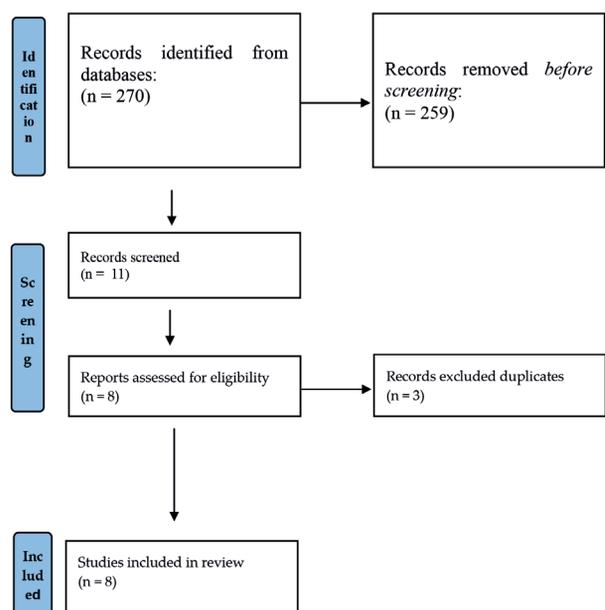


Fig. 1. Diagram of the systematic literature review (n—number of records)

These records were then assessed for compliance with the inclusion and exclusion criteria on the basis of abstract analysis. Of the 270 articles initially shortlisted for further analysis, 259 were rejected at this stage. The 11 remaining articles were subjected to content analysis and a further 3 were rejected on the basis of further analysis due to duplication. The remaining 8 articles were subjected to further analysis (Fig. 1).

All the articles collected were analysed in terms of the following parameters/content: which form/measure/physiotherapy modality was used in the treatment of endometriosis to reduce pain, what conclusion was obtained as a result of the review, and whether there was an assessment of a biomarker used for diagnosing endometriosis (to infer whether the form/measure/physiotherapy used affects the course of endometriosis).

REVIEW

The use of physical factors, physical activity and complex therapies to reduce pain in women with endometriosis.

EXERCISE

Hansen et al. (2021) reviewed articles to check whether exercise has an effect on pain reduction in women with endometriosis. Based on their review, the authors concluded that exercise does not have a positive effect on pain and suggested that randomised trials with correctly calculated power, well-defined study groups and training programmes should be conducted to answer the question of whether exercise can alleviate pain in patients with endometriosis. The articles reviewed did not determine the marker microRNA [23]. In this article, the literature list consisted of 27 publications [23] (Table 1).

Tennford et al. (2021) also reviewed the impact of exercise and physical activity. The authors were unable to conclude that exercise and physical activity have an effect on pain reduction in endometrial patients. Moreover, they believe that these subjects require studies with a well-designed methodology, using reliable and validated tools [24]. This article did not determine an microRNA marker either. The literature list comprised 40 items [24] (Table 1).

Table 1. Types/forms treatment used in endometriosis

Study	Treatments	Conclusion	Marker assessment (microRNA)
Hansen et al., 2021 [23]	Exercise	Exercise has no positive effect on pain. The authors suggest that randomised trials with properly calculated power, well-defined study groups and training programmes should be conducted.	No
Tennford et al., 2021 [24]	Exercise Physical therapy	Exercise and physical activity have no effect on pain reduction in endometritis patients. The authors also believe that the topic requires a study with a well-designed methodology, using reliable and validated tools.	No
Habek et al., 2021 [25]	Balneotherapy	The use of balneotherapy and hyperthermic hydrotherapy in endometriosis is contraindicated.	No
Mardon et al., 2022 [26]	Surgical treatment, pharmacotherapy, psychological care, physiotherapy	The most commonly recommended treatment including that for women with endometriosis is surgery, pharmacotherapy, psychological care and physiotherapy. The authors indicate that there is currently no consensus on what should be recommended in clinical practice for persistent pelvic pain.	No
Goździewicz et al., 2022 [27]	Myofascial trigger points, visceral manual therapy	The importance of using physiotherapy in the form of working with myofascial trigger points and visceral manual therapy to reduce symptoms of endometriosis disease. The authors note prospective studies in relation to surgical treatment and visceral therapy in patients with endometriosis.	No
Mira et al., 2020 [28]	TENS Applied TENS and hormonal therapy for 8 weeks at the S3–S4 region, 30 minutes session. Included a hundred-one participants with DIE in electrotherapy (n=53) (hormonal treatment + electrotherapy) or control group (n=48) (only hormonal treatment) by 8 weeks of follow-up. The primary measurement was chronic pelvic pain (CPP) using a visual analogue scale (VAS) and deep dyspareunia. The secondary outcomes were the quality of life by endometriosis health profile (EHP-30) and sexual function by female sexual function index (FSFI).	Alleviation of CPP was observed only in the electrotherapy group. In terms of profound dyspareunia, improvement was observed for both groups. Considering the secondary outcomes, a higher post-treatment total score for EHP-30 was observed in both groups. With regard to sexual function, a statistically significant improvement in the FSFI score was observed in the electrotherapy group, with an increase in scores in the domains of lube and pain.	No

Del Forno et al., 2021 [29]	<p>Pelvic Floor Muscle Physiotherapy</p> <p>Before the start of therapy, the participants received information on pelvic floor anatomy and function, with the help of anatomical illustrations. In addition, the physiotherapist, experienced in pelvic floor muscle dysfunction, performed a digital evaluation of the pelvic floor muscle tone. This was performed after the TPU, given that digital examination may induce pain with consequent contraction of the pelvic floor, which could affect the LHA assessment. Pubococcygeus and ischiococcygeus muscle tone were assessed bilaterally at rest, and during pelvic floor contraction and relaxation. After the first examination, the women in the study group underwent five individual sessions of PFP, of 30 min each, on weeks 1, 3, 5, 8 and 11. In each session, the women underwent a Thiele massage, which consists of digital pressure and subsequent stretching of the muscles in order to relax them, restoring normal pelvic floor tone and the ability to coordinate muscle behavior. Participants were assigned randomly to no intervention (control group) or to receive PFP sessions (study group) in a 1:1 ratio. Block randomization was computer generated and the allocation was hidden in opaque envelopes until randomized. following inclusion criteria: age between 18 and 45 years, clinical and ultrasound diagnosis of DIE and associated superficial dyspareunia. Exclusion criteria included previous or current genital malignancy, pelvic organ prolapse, previous surgery for DIE, current or previous pregnancy, congenital or acquired abnormalities of the pelvis or pelvic floor, history of sexual abuse, current genitourinary infection and presence of other causes of CPP; written informed consent was obtained from all participating women. Four months after randomization, all participants underwent a second examination, in which they were asked to rank again their endometriosis-related pain symptoms and underwent another 3D/4D-TPU assessment of the LHA at rest, on maximum PFMC and on maximum Valsalva maneuver. In addition, the women in the study group were asked to rate their satisfaction with their physiotherapy treatment using a 5-item scale (1, very dissatisfied; 2, dissatisfied; 3, neither satisfied nor dissatisfied; 4, satisfied; and 5, very satisfied).</p>	<p>In conclusion PFP seems to be effective in improving pelvic floor muscle relaxation, superficial dyspareunia and CPP in women with DIE. As such, the studied physiotherapy protocol may improve patients' quality of life and sexual life, which are often compromised in women with DIE11,43. 3D/4D-TPU is a reliable, objective and non-invasive method for assessing the pelvic floor muscles in these women. In the current context of tailored, multidisciplinary care40, PFP may represent an additional valid, minimally invasive, innovative and well-tolerated therapeutic option for women with DIE, particularly those with superficial dyspareunia and CPP.</p>	No
del Mar Salinas-Asensio et al., 2022 [30]	<p>Physio-EndEA' Study</p> <p>A total of 22 symptomatic endometriosis women will be randomized 1:1 to the Physio-EndEA or usual care groups.</p> <p>The Physio-EndEA' program consist of a one-week lumbopelvic stabilization learning phase followed by an eight-week phase of stretching, aerobic and resistance exercises focused on the lumbopelvic area that will be sequentially instructed and supervised by a trained physiotherapist (with volume and intensity progression) and adapted daily to the potential of each participant. The primary outcome measure is HRQoL. The secondary outcome measures included clinician-reported outcomes (pressure pain thresholds, muscle thickness and strength, flexibility, body balance and cardiorespiratory fitness) and patient-reported outcomes (pain intensity, physical fitness, chronic fatigue, sexual function, gastrointestinal function and sleep quality).</p>	<p>The establishment of this type of intervention could benefit the HRQoL of symptomatic women with endometriosis. Moreover, it might reduce the direct and indirect costs of this health problem.</p>	No

BALNEOTHERAPY

Habek et al. point to the use of balneoclimatology in gynaecological diseases in their review published in 2021. The authors point out that in endometriosis, the use of balneotherapy and hyperthermic hydrotherapy is contraindicated, due to the strong congestion effect following these treatments [25]. The review did not show that a microRNA marker was determined. The literature list totalled 36 entries [25] (Table 1).

TREATMENT RECOMMENDATIONS FOR THE MANAGEMENT OF PERSISTENT PELVIC PAIN

Mardon et al. provided treatment recommendations for persistent pelvic pain in their 2022 Puliked review. The literature review provided information that the most commonly recommended treatments including for women with endometriosis are surgical treatment, pharmacotherapy, psychological care and physiotherapy. The authors indicate that there is currently no consensus on what should be recommended in clinical practice for persistent pelvic pain [26]. The review did not identify microRNA. In their publication, the authors referred to 69 items from the literature [26] (Table 1).

MYOFASCIAL TRIGGER POINTS, VISCERAL MANUAL THERAPY

In a review published in 2022, Goździewicz et al. highlight the use of physiotherapy in the form of working with myofascial trigger points and visceral manual therapy to reduce symptoms of endometriosis disease. The authors also note prospective studies relating to surgical treatment and visceral therapy in endometriosis patients [27]. The review did not report the determination of a microRNA marker. The authors referred to 44 items from the literature [27] (Table 1).

TENS – TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION

Mira et al. (2020) conducted a study to evaluate the clinical effectiveness of TENS (Transcutaneous Electrical Nerve Stimulation) versus standard hormone-only treatment for DIE (Deep Infiltrating Endometriosis) [28]. Only in the group in which TENS electrostimulation was performed was a reduction in CPP (Chronic Pelvic Pain) observed, with with a statistically significant improvement in the FSFI (Female Sexual Function Index) score also being found, with regard to sexual function. In terms of profound dyspareunia, improvements were observed in both groups. Considering secondary outcomes, a higher post-treatment total score for the EHP-30 (Endometriosis Health Profile) was observed in both groups [28] (Table 1). Pizyxane results indicate that TENS electrostimulation is a good method for reducing CPP pain and deep dyspareunia, thereby improving women's quality of life and sexual function [28]. In this study, no assessment was made of the levels of the endometriosis biomarker microRNA.

PELVIC FLOOR PHYSIOTHERAPY – PELVIC FLOOR MUSCLE PHYSIOTHERAPY

Del Forno et al. (2021) conducted a study among women with Deep Infiltrating Endometriosis (DIE), who had

chronic pelvic pain, dyspareunia and pelvic floor muscle hypertonia. The aim of the study was to assess PFP (Pelvic Floor Physiotherapy) and how it affects the area of levator ani muscle occlusion during the Valsalva manoeuvre, which was assessed by transabdominal ultrasonography, in women with DIE suffering from superficial dyspareunia [29]. Before and after the physiotherapy sessions, the participants of the study underwent a 3D/4D transperineal ultrasound. The study women had individual PFP sessions by a qualified physiotherapist. The results indicated that there was a marked reduction in pelvic pain in the group in which PFP was performed, thus achieving pelvic floor muscle relaxation [29] (Table 1). The microRNA marker was not assessed in this study.

PHYSIO-ENDEA' STUDY

Del Salinas-Asensio et al. (2022) conducted a study called 'Physio-EndEA' on the Health-Related Quality of Life (HRQoL) of women with symptomatic endometriosis. It was designed to check what benefits may occur using a therapy exercise programme (focused on lumbo-pelvic stabilisation and exercise tolerance). The 'Physio-EndEA' programme consisted of a one-week lumbo-pelvic stabilisation learning phase, followed by an eight-week phase of stretching, aerobic and resistance exercises focused on the lumbo-pelvic area, which included sequential instruction and supervision by a trained physiotherapist (with a progression of volume and intensity), with exercises adjusted daily according to the woman's needs and each participant's capabilities [30]. The following were also assessed: pain levels, muscle thickness and strength and flexibility, body balance and cardiorespiratory fitness) and outcomes described by the participants (pain intensity, physical fitness, chronic fatigue, sexual function, gastrointestinal function and sleep quality). The 'Physio-EndEA' programme has a positive effect on HRQoL in women with endometriosis [30] (Table 1). The microRNA marker was not determined in this study either.

DISCUSSION

Despite the high incidence of endometriosis in women, the review indicates that physiotherapy is not widely used in the management of pain in women with endometriosis. Exercise and physical activity were most commonly used, but these have not been shown to be effective in reducing pain in endometriosis [23, 24].

The Pelvic Floor Physiotherapy and the Physio-EndEA' Study is worth noting. These studies showed the positive effects of exercising selected pelvic floor and trunk muscles [29, 30]. Performing exercises for the muscles of the pelvic floor and trunk requires a thorough discussion with a physiotherapist on this should be done; certainly, supervision by a physiotherapist during exercise is important – it allows the woman's starting position to be corrected during exercise. Furthermore, it should be noted that the effectiveness of the exercises is related to their regular implementation [29, 30].

Balneoclimatology can be a good form of complementary treatment in gynaecological diseases, but in the case of endometriosis its use is contraindicated, due to the deep congestion effect achieved [25].

In physiotherapy, musculo-fascial therapy, which includes the deactivation of myofascial trigger points, is significant [27]. This therapy is also used in gynaecological physiotherapy, achieving an improvement in women's pelvic pain experience [31].

In physiotherapy clinical practice, the use of visceral manual therapy is noteworthy [32, 33]. However, despite patients reporting improvements after its use, the efficacy of visceral manual therapy needs to be confirmed based on research, with a well-designed methodology.

When carefully instructed by a physiotherapist, TENS electrostimulation can be performed by the woman at home, which will translate into more regular treatments [28]. This is possible due to the availability of a small and therefore lightweight device, while newer devices also have a preloaded programme for TENS electrostimulation [28]. The most common treatment for women with endometriosis is surgical and pharmacological treatment [26].

Depending on the surgical technique selected, surgical treatment leaves a scar in and on the patient's body, which also requires physiotherapy intervention by mobilising it [34, 35]. Pre- and postoperative physiotherapy to prepare the woman's musculoskeletal system to function after surgery should, of course, be kept in mind [36].

Despite their widespread use for pelvic pain caused by endometriosis, there is a lack of evidence of the efficacy of NSAIDs [37]. The surgical treatment used is challenging and still debatable as pain relief after removal of endometrial tissue has not been demonstrated [6, 38, 39]. It has been suggested that vitamin C and E should be supplemented in women with endometriosis in order to reduce oxidative stress and pelvic pain sensations [40]. It is thought that noninvasive biomarkers, proteomics, genomics, and miRNA microarray could be very useful in diagnosing endometriosis. However, this requires further research involving large study groups, along with a better understanding of the pathophysiological mechanisms [41].

During endometriosis, due to chronic pelvic pain, women often experience an unfavourable psychological state,

depressive states, anxiety symptoms and psychosomatic disorders [42]. In the reviews presented here, physiotherapy in the form of treatments, e.g. magnetotherapy, electrotherapy, light therapy, laser therapy as complementary treatment for women with endometriosis seems to be highly underestimated [28, 43-47]. The clinically used endometriosis marker microRNA [8-11] is not used by physiotherapists, which is certainly due to their professional competence. Nevertheless, controlling the treatment by determining this marker would allow the effectiveness of the physiotherapeutic interventions used to be monitored. Due to the complexity of this disease, the treatment of women with endometriosis should be an interdisciplinary treatment involving close cooperation between gynaecologists and physiotherapists.

In view of the high cost of treatment in each country, it is certainly the case that non-pharmacological methods/procedures to reduce pain among women with endometriosis and thus physiotherapeutic methods/procedures to improve the quality of life of women can be a good solution for the economics of medical care but especially for the affected women. Physiotherapy methods/symptoms are also non-invasive treatment procedures and the authors therefore emphasise their significance for practical application [48, 49].

CONCLUSION

The literature review conducted here suggests that it is necessary to carry out multicentre studies in order to ascertain which forms of physiotherapy and balneotherapy may be most effective in reducing pain and improving the quality of life of women suffering from endometriosis.

It would certainly be useful to conduct multi-centre studies in different countries to prepare a treatment algorithm for women with endometriosis. Without doubt, this type of research in conjunction with the assessment of pain and endometriosis markers would be of great clinical value for developing an interdisciplinary treatment model. It might be the case that the failure to determine microRNA marker levels in publications demonstrating physiotherapy interventions was due to limited research funding.

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Preprint: doi: 10.20944/preprints202308.2089.v1
<https://www.preprints.org/manuscript/202308.2089/v1>

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CONFLICTS OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 31.08.2023

ACCEPTED: 08.10.2023



* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

THE REHABILITATION OF POST-TRAUMATIC STRESS DISORDER OF SERVICEMEN: CERTAIN ASPECTS

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ABSTRACT

Aim: This article reviews and assesses the problematic and topical issues of rehabilitation of servicemen who have post-traumatic stress disorder (PTSD) caused by trauma and stress during and after the completion of combat operations, and special tasks. Analysis and generalization of types of rehabilitation are based on international experience and identification of measures to overcome PTSD.

Materials and Methods: The research is based on the analysis of international documents, empirical and analytical data of the World Health Organization, international and public organizations dealing with the treatment and rehabilitation of military personnel and war veterans, scientific and analytical studies related to the types of rehabilitation used to overcome the negative consequences of PTSD. Both general and specific scientific methods are applied as the foundation of the methodology: dialectical; systemic and structural; conceptual and comparative; methods of analysis, synthesis, and observation.

Conclusions: The duration of stay in the combat zone, the deaths of comrades and civilians, violent acts, and the use of weapons against the enemy undoubtedly affect the psychological state of servicemen and can lead to the development of post-traumatic stress disorder. Psychological support and rehabilitation of servicemen are necessary to restore psychological health and reduce the severity of the consequences of psychological injuries, stressful conditions, and aberrant behavior outside the combat zone. Introducing new methods, technologies, tools, development of programs, and guidelines for rehabilitating military personnel suffering from post-traumatic mental disorders should be universally accepted. International experience is especially important for developing and improving the rehabilitation system. International organizations should develop a single, generally accepted mechanism for overcoming the consequences of PTSD, taking into account the practice of countries that are actively working in this direction.

KEY WORDS: rehabilitation, stress, psychodrama, psychological rehabilitation, post-traumatic stress disorder

INTRODUCTION

The war on the territory of Ukraine became a new challenge in the development of the system of public relations, social protection, and health care throughout the world. In particular, this is reflected, first of all, in the health of military personnel not only of our country but also of other countries who have expressed a desire to stand up for the defense of our state. Health, as defined by the World Health Organization (WHO), is a state of complete physical, mental, and social well-being, and not just the absence of disease or physical defects [1].

"Health care", according to the legislation of Ukraine, is a system of measures carried out by state authorities and local self-government bodies, their officials, health care institutions, medical and pharmaceutical workers, and citizens, to preserve and restore physiological and psychological functions, optimal working capacity and social activity of a person with the maximum biologically possible individual length of his life [2].

Stressful events to which military personnel are exposed have a negative psychological effect on them. Today, they are the most vulnerable both physically, morally, and psychologically as a result of constant stress overloads.

The issue of the psychological state of persons participating in hostilities deserves special attention. The state of health of military personnel is negatively affected by the trauma experienced during hostilities, and therefore they require increased social attention and the organization of a comprehensive rehabilitation system. It is worth noting that military personnel receive psycho traumas during hostilities and as a result of a stressful situations.

Stress is a type of functional state characterized by increased physiological and mental activity. It is characterized by extreme instability. Scientists define "stress as a non-specific response of the body to the external or internal demands proposed to it" [3].

The activities of professional soldiers are a significant source of mental and emotional stress, whether in peacetime or during periods of hostilities. As a result, some military personnel may experience symptoms of chronic stress and post-traumatic stress disorders [4].

AIM

This article reviews and assesses the problematic and topical issues of rehabilitation of servicemen who have

post-traumatic stress disorder (PTSD) caused by trauma and stress during and after the completion of combat operations, and special tasks. Analysis and generalization of types of rehabilitation are based on international experience and identification of measures to overcome PTSD.

MATERIALS AND METHODS

The research is based on the analysis of international documents, empirical and analytical data of the World Health Organization, international and public organizations dealing with the treatment and rehabilitation of military personnel and war veterans, scientific and analytical studies related to the types of rehabilitation used to overcome the negative consequences of PTSD. Both general and specific scientific methods are applied as the foundation of the methodology: dialectical; systemic and structural; conceptual and comparative; methods of analysis, synthesis, and observation.

REVIEW AND DISCUSSION

With the beginning of the hybrid war of the Russian Federation against Ukraine in 2014, Ukrainian researchers began to actively study the experience of other countries regarding the rehabilitation of servicemen after participating in hostilities [5]. In addition, starting from 2014 and following, more than 10,000 military personnel have become disabled due to mental disorders.

PTSD requires professional medical care and rehabilitation and is the most negative manifestation of the health of people participating in hostilities.

A regulation "On the psychological rehabilitation of servicemen of the Armed Forces of Ukraine and the State Special Transport Service who participated in an anti-terrorist operation, carried out measures to ensure national security and defense, repel and deter armed aggression of the Russian Federation in the Donetsk and Luhansk regions, or performed official (combat) tasks in extreme conditions" approved by the order of the Ministry of Defense of Ukraine dated 09.12.2015 No. 702 introduced into circulation such concepts as:

- combat mental trauma (hereinafter – BPT) – a pathological condition of the central nervous system, which arises as a result of the influence of factors of combat stress and determines the regulation of the behavior of the victim through pathophysiological mechanisms;
- combat stress – a multi-level process of adaptive activity of the human body in the conditions of an extreme combat situation, which is accompanied by the tension of reactive self-regulation mechanisms and the consolidation of specific adaptive psychophysiological changes. Combat stress is a pre-pathological destabilizing state that exhausts the body's functional reserve, and increases the risk of mental disintegration and persistent somato-vegetative dysfunctions [6].

However, these concepts do not reveal the content of the disease itself.

PTSD is a clinical disease that is a complex of severe symptoms and requires special treatment.

According to the research, the risk of developing PTSD is very high for every person who takes part in combat

operations. According to statistics, approximately 60-80% of servicemen have signs of acute trauma. If they are not given the necessary psychological help at this moment, it can lead to such consequences as PTSD. The risk increases in the following cases:

- if the person has previously been diagnosed with some mental disorder;
- there was already an experience of a traumatic event; trauma is associated with the death of relatives, the death of a large number of people, or if it caused serious changes in life;
- a person has no relatives with whom he can share his experiences [7]. According to Merck & Co., Inc., Rahway, NJ, USA, PTSD symptoms can be divided into the following categories: intrusion, avoidance, negative changes in cognitive function and mood, and changes in arousal and reactivity. Most often, patients have frequent unwanted memories in which the traumatic event is repeated. Nightmares about the event are often present. Less common are short-term dissociative states upon awakening in which events are experienced as if they were happening again (flashbacks), sometimes causing patients to react to them as if they were in a real situation (for example, loud noises such as fireworks can provoke flashbacks about engaging in combat, which in turn may result in patients scrambling for cover or falling to the ground for protection). Patients avoid stimuli associated with the trauma and often experience emotional numbness and disinterest in daily activities. Depression, other anxiety disorders, and substance use are common among patients with chronic PTSD [8]. Also, the main symptoms of PTSD syndrome include the following: sleep disturbances (repeated unpleasant dreams containing a traumatic event); and pathological memories (obsessive return to an extreme situation).

Memories can be arbitrary, involuntary, and obsessive, as well as continuous or appear in separate attacks. As a rule, they are affectively charged and are accompanied by feelings of guilt, anxiety, resentment, anger, fear; inability to remember – amnesia for some events (avoidance of everything that reminds of the most extreme moments); hypersensitivity, increased excitability (violation of attention concentration, inadequate hypermobilization, increased anxiety, increased reactions to stimuli, sudden outbursts of anger, guilt, longing, anxiety, fear, which are analogous to the affective component of memories of the event); flashback effects – a sudden action or feeling as if a traumatic event is happening again; avoidance of trauma-related stimuli (thoughts, feelings, situations); various neurasthenic symptoms: feeling of fatigue, memory loss, irritability, autonomic symptoms, depression and headaches, decreased interest in meaningful activities, alienation, narrowing of the spectrum of feelings [3, p. 8-9].

People under the age of 22 or over 30 are the most vulnerable. Regarding gender characteristics, scientists note that 8% of men and 20% of women develop PTSD after traumatic events [9].

Stressful situations that arise in conditions of constant danger and increased risk to life and health seriously affect the emotional state of the individual and lead to a decrease in the adaptation capabilities of the entire body. This creates prerequisites for the emergence of various psychological personality disorders, and maladaptive behavior. Therefore, in the future, these people need rehabilitation. Scientists investigating the issue of psycho trauma of servicemen and possible manifestations of personality maladjustment focus their attention on the fact that maladaptive behaviors and post-traumatic personality changes are manifested in persons who have visited war zones and participated in such actions. With this in mind, signs of maladaptation include fear, confusion, suicidal attempts, requests for hospitalization, leave, narrowing of contacts, etc. In addition to the signs, the factors of personality maladjustment will also be highlighted, which are: 1) a difficult moral and psychological situation in the military team, caused, in particular, by non-statutory relations between military personnel and violation of discipline during the state of emergency by commanders and superiors. 2) official factors: lack of study of servicemen and their depressed state in connection with the need to undergo military service in a "hot spot", to carry out guard duty and combat duty with weapons. 3) age factors: characterological features of conscripts; 4) chronological factors are related later to the year of hostilities, determined by days of the week and time of day. 5) individual and personal factors: outlook, active use of alcohol and other drugs. Factors such as living standards and quality of life, understanding of civic duty, presence of patriotism, and a sense of national pride are social indicators of a certain society, of which an individual is a member, play an important role [10].

According to the results of international studies, in countries where the war took place, the prevalence of PTSD among persons who were in the war zone doubled and reached 15-20%. In a significant part of people who have experienced a psycho-traumatic event, problems in the field of mental health may not arise immediately, but appear after some time and may manifest themselves not only as PTSD but also in the form of other disorders, in particular: abuse of psychoactive substances, depression, anxiety disorders, loss of control, outbursts of anger, etc. [11].

People with PTSD have an increased risk of HIV infection, hepatitis, smoking, and addiction to psychoactive substances. Therefore, the focus of psychotherapeutic help should be on alcohol and drug addiction. PTSD in military personnel can also be complicated by a brain injury. Military personnel may have problems of a sexual nature, which are usually associated with stress disorders [12].

There are also difficult situations when a person is exposed to various factors: danger, uncertainty, stress, psychological and physical strain, and some unfavorable conditions during the performance of the tasks set before him.

Several problems with the rehabilitation of servicemen suffering from PTSD are identified in international practice. American researchers have indicated two main problems in working with ex-combatants suffering from PTSD, namely: the multidimensionality of the disorder itself, and the

difficulty in involving veterans in therapy. Concerning the first issue, psychiatrist Dr. Jonathan Shay, whose circle of interest is focused specifically on working with patients suffering from PTSD, proposed the term "moral injury" to denote the psychological, cultural, and spiritual aspects of combat trauma. PTSD specialist Dr. Sheila Jain concluded in her research that the disorder makes military service members and veterans vulnerable [13].

The problem of preserving the life and health of military personnel who have participated in military operations is quite urgent and has attracted the attention not only of scientists but also of society as a whole. In connection with this, the vast majority of servicemen need restorative treatment and rehabilitation.

Rehabilitation is a set of coordinated measures of a medical, psychological, social, and pedagogical nature aimed at restoring health, psychological status, and the ability to perform physical functions in persons who have lost these capabilities as a result of illness or injury. The goals of rehabilitation are:

- elimination of the potential and actual danger of mental illness;
- reintegration of the individual from the abnormal situation to the normal conditions of his previous life, which preceded the traumatic situation;
- restoration of a person's personal and social status [3, p.29].

The WHO Committee of Experts on Rehabilitation (1963) emphasized that rehabilitation is a process whose purpose is to prevent disability during the treatment of diseases and to help the patient achieve the maximum physical, mental, professional, social, and economic fulfillment that he will be capable of within the limits of the existing disease [14].

Rehabilitation also means the use of various opportunities to reduce the influence of factors that limit a person's life or lead to disability; providing persons with disabilities the opportunity to achieve optimal social integration [15, p.21-22].

Among the main types of rehabilitation, it is customary to distinguish between those which are medical, psychological, professional, physical, social, pedagogical, legal, etc. Special attention should be paid to psychological rehabilitation for the recovery of servicemen after the detection of post-traumatic stress disorder.

Thus, according to the definition of WHO, mental health is a state of well-being in which each person can realize his potential, cope with life stresses, work productively and fruitfully, and also contribute to the life of his community [16].

Psychological assistance can expand the capabilities of a person in their personal and social functioning. At the same time, psychological rehabilitation is a system of measures aimed at restoring or correcting psychological functions, qualities, states, and properties of victims of traumatic events who are experiencing acute or chronic post-stress and related disorders, as well as creating favorable conditions for the development and realization of personal needs.

The most intensive level of rehabilitation measures are carried out to restore or compensate for disturbed mental

functions, personal qualities, and the system of relationships of persons; restoration or constructive compensation of mental and social adaptation mechanisms; creation of conditions for a full exit from the crisis state and post-crisis personal growth; restoration of vitality and work capacity. Diagnosis and psychotherapy of post-stress symptoms and associated disorders (for example, sleep disorders, manifestations of aggression, somatic pain, depression, anxiety disorders, etc.) are carried out, including follow-up after the end of the active phase of treatment; diagnosis and psychotherapy of adjustment disorders, in particular, addiction to psychoactive substances, complicated reaction to loss, dissociative disorders, etc. Depending on the specifics of the situation, the request, and the current state of a person with a traumatic experience, Intensive rehabilitation is inclusive of all forms of assistance; individual psychotherapy; family psychotherapy; and group psychotherapy. Psychotherapy is the purposeful regulation by psychological means, through professional standardized procedures, of the disturbed activity of the body and psyche of the client to restore or compensate his mental functions, personal properties, and interpersonal relationships, as well as improving the physical condition and quality of life [17, p.20].

The participation of military personnel and persons equated to them in hostilities is, without a doubt, a stress factor of the highest degree of intensity. Therefore, a mandatory component of the complex of rehabilitation measures for persons injured as a result of participation in hostilities should be medical and psychological rehabilitation, taking into account all the subtleties and conditions in which the said subjects are. In addition, several types of rehabilitation can be aimed at overcoming the negative consequences of participation in such actions. These include 6 professional, external, medical, and psychological interventions.

Professional rehabilitation of servicemen is a set of measures aimed at restoring professional skills or retraining servicemen, solving their employment issues. The next type is emergency rehabilitation; a set of measures for timely prevention and rapid recovery of disturbed psychosomatic functions, aimed at maintaining working capacity, appropriate reliability of servicemen's activities, and prevention of various diseases. The medical rehabilitation of military personnel is a system of measures aimed at the prevention of pathological processes that lead to a temporary loss of combat and working capacity and at the early return of the wounded (including the disabled) to society. Psychological rehabilitation of combatants should include a system of medical and psychological measures aimed at restoring emotional and motivational spheres and achieving an optimal level of adaptation of the personality and professional qualities of the wounded, which ensures military professional efficiency. Rehabilitation measures should be aimed not only at eliminating or improving the physical condition of the injured but also at eliminating psychological problems to help patients reintegrate into the family and society as a whole [18,19,20].

Today, in Russia's war on Ukraine, the main part of the military, in one way or another, suffers from post-traumatic stress

disorder (given the terrible realities in which they perform their combat tasks). The return to normal life necessarily requires rehabilitation. Thus, by the Law of Ukraine "On Social and Legal Protection of Servicemen and Members of Their Families" during the period of martial law, servicemen who directly participated in the implementation of measures necessary to ensure the defense of Ukraine, the protection of the safety of the population and the interests of the state in connection with military aggression of the Russian Federation against Ukraine, while being directly in the areas of implementation of the specified measures, may be sent, by the conclusion of the military medical commission, for further medical care or medical and psychological rehabilitation to medical institutions located outside of Ukraine [21].

For a more effective rehabilitation and recovery of health, we believe that the international experience of several countries that were and are at war should be considered, as to what options they use to overcome the consequences of PTSD.

Thus, in The United States of America, the system of rehabilitation measures in the Armed Forces is carried out under the leadership of the heads of the medical departments of the Air Force and the Navy, as well as the commander of the medical command of the ground forces as part of the implementation of the system of measures for "return to military service" [22]. Such a system includes preventive, social, and rehabilitation technologies for servicemen and their family members. The structure of the medical service of the US Armed Forces includes resort centers, boarding houses, and recreation centers, including those located in places of accommodation on the territory of foreign countries, intended mainly for the organized recreation of military personnel and their family members. Measures for the medical rehabilitation of military personnel are carried out in hospitals and specialized departments of large medical organizations [23].

In the USA there are a large number of institutions for the rehabilitation of military personnel operating under the leadership of the Department of Veterans Affairs. The department has expanded clinical programs to provide active detection of depression, PTSD, alcohol problems, military sexual trauma, and mental health recovery in primary care, and other medical and rehabilitation facilities [24, p.49]. In addition, the Department has developed specialized protocols for providing psychotherapeutic and pharmacological assistance. Such protocols characterize the stages of providing psychological assistance to military personnel, which are divided as follows: 1) prevention of stress disorders and resilience training; 2) psychological first aid; 3) early psychological assistance; 4) diagnosis and treatment of PTSD.

In addition, in the US Army, each military unit must professionally master the methods of combat stress control, in particular, the methods of primary, secondary, and tertiary prevention of stress. At the level of divisions and brigades, mental health departments headed by psychiatrists have been established. The departments are staffed with mental health officers who have a relevant master's degree in psychology or social work, a license to practice, and a minimum of one year of practical work in medical facilities. The powers of mental health departments include provision of medical services;

planning of mental health care services in the military unit and supervision of the quality of the provision of such services; consulting division commanders and doctors on mental health issues; cooperation with chaplains responsible for issues of combat stress; cooperation with medical personnel accompanying military personnel abroad; mentoring and ensuring the training of medical personnel in the latest practices of diagnosis and treatment of psychological and mental disorders, diagnosis and preparation of reports on the risk of committing suicide in the military, etc. It should be noted that a positive step in the fight against PTSD is the introduction of the "Battlemind" program, which is designed for soldiers, commanders, and military spouses, is based on positively oriented approaches, relies on the strengths of program participants, the idea of mutual support and respect for the commander as responsible for the mental health of military personnel [24, p. 48]. Complementary and alternative medicine methods are widely used for the treatment and rehabilitation of military personnel and veterans. Thus, for the rehabilitation of military personnel with post-traumatic stress disorder, in addition to psychotherapy, medication, and physiotherapy, the possibility of using medicinal products on a natural basis is used, namely phytotherapy, homeopathy, and biologically active food supplements. In addition, yoga, Chinese gymnastics, and therapy involving animals (zootherapy, animal therapy) are used. Moreover, these methods are included in the US clinical practice guidelines.

Speaking about Israel's experience, the war in that country has been going on for more than a decade, and the experience accumulated by Israeli specialists in the field of rehabilitation of victims of military operations and terrorist attacks is important and unique. Israeli specialists have developed high-quality, efficient, and effective technologies for countering the psychological and psychiatric consequences of military crises [25].

The Ministry of Health, the Ministry of Defense, and the Ministry of Internal Affairs are responsible for the organization of psychological assistance in the Israeli army, which often creates a single headquarters for coordination in crises, including military operations, and terrorist acts. In addition, there are organizations engaged in social and psychological support of veterans [26, p. 110]. There are more than 2,500 professional military psychologists in this country. However, during active military operations, reservists are also called up for service. The number of military psychologists and social workers approaches the following indicator: one specialist for 70-90 military personnel [27].

The Israeli system of psychological support consists of five major divisions: the division of diagnostics, profiling, and career guidance; a psychological support service for servicemen; a unit for rehabilitation and work with demobilized persons; a civil population support service in crises; and a service for working with families of victims [24, p. 52].

Various methods are used for the mental rehabilitation of combatants and veterans suffering from PTSD and other acquired psychological disorders. The main ones are cognitive-behavioral therapy; emotionally focused

therapy; exposure therapy; group therapy; relaxation and meditation techniques; and self-regulation techniques [26, p. 112-115].

The fact that Israel has a system of social assistance to the civilian population in the conditions of hostilities deserves special attention. In every micro-district of the population centers of the country, voluntary headquarters of crises have been established; population notification points; and urgent care points. In addition, informational banners are placed at places of residence, training is regularly conducted, the method of "false alarms" is used, explanatory work is conducted in schools and colleges, and special methods of information delivery have been created for younger children [28].

Rehabilitation of military personnel and war veterans also takes place under various programs developed by special organizations and practicing psychologists. Israel is actively helping Ukraine in the rehabilitation of military personnel, in addition to those with PTSD symptoms. Ukrainian psychologists are invited to study in this country to gain as much experience as possible, and in the future, to spread it in matters of rehabilitation and recovery from the longevity of the military and civilian population on the territory of Ukraine.

Although, it must be recognized that since 2014, Ukraine has adopted separate normative legal acts regarding the rehabilitation of military personnel, in particular:

- Law of Ukraine "On social and legal protection of military personnel and members of their families", which regulates the obligation to conduct free psychological, medical, and professional rehabilitation in special medical centers [21];
- Decree of the Cabinet of Ministers of Ukraine "On the approval of the plan of measures for a medical, psychological, professional rehabilitation and social adaptation of participants in the anti-terrorist operation", the provisions of which defined a set of measures to create a unified system of psychological rehabilitation and the provision of social support for the participants of the ATO and their family members, taking into account foreign experience of the functioning of such systems in post-conflict situations [29]. However, today this document has lost its validity.

In 2014, the Cabinet of Ministers of Ukraine established the State Service of Ukraine for war veterans and participants in the anti-terrorist operation. The main purpose of this was the implementation of the state policy of war veterans and participants of the anti-terrorist operation, namely providing the latter with psychological rehabilitation, sanatorium-resort treatment, and technical and other means of rehabilitation. In 2018, the service was reorganized and later liquidated. Instead, in 2019, the Ministry of Veterans Affairs became operational.

In addition, the Order of the Ministry of Health of Ukraine dated 23.02.2016 No. 121 approved the Unified clinical protocol of primary, secondary (specialized) and tertiary (highly specialized) medical care: (UCPMD) "Reaction to severe stress and disorders adaptation Post-traumatic stress disorder", which was developed taking into account the modern requirements of evidence-based medicine,

considers the peculiarities of diagnosis and treatment of patients with post-traumatic stress disorder (PTSD) in Ukraine from the standpoint of ensuring the continuity of the stages of medical care [30, p.2].

In general, the international evidence for post-traumatic stress disorder rehabilitation is extensive and country-specific. However, developed mechanisms to combat this negative phenomenon, created special bodies and approved programs are effective and provide an opportunity to receive appropriate qualified assistance. In addition, the exchange of experience between countries and the training of country representatives gives a certain positive result. The problem of preserving the life and health of military personnel is quite urgent at the moment, and the possible ways to solve it are necessary.

CONCLUSIONS

Summing up the research presented above, it is worth paying attention to the following.

The provision of rehabilitation services, especially in the field of overcoming post-traumatic stress disorder in military personnel who have participated in hostilities, is quite relevant. Since rehabilitation is the most effective means of overcoming this negative phenomenon.

The length of stay in the combat zone, the death of fellow soldiers and civilians, violent acts, the use of weapons against the enemy undoubtedly affect the psychological state of servicemen and can lead to the development of post-traumatic stress disorder.

T. Banner states that the negative effects on the psyche of military personnel are manifested in the general disorganization of behavior, the inhibition of previously developed skills, inadequate reactions to external stimuli, difficulties in dividing attention, narrowing the scope of attention and memory, impulsive actions, and in significant vegetative changes. In the condition of long-term influence of the factors causing these conditions, violations of the

mechanisms of biological adaptation and compensation become irreversible and in the future become a prerequisite for the occurrence of neuropsychiatric disorders and disorders [31].

Rehabilitation in such cases is inevitable to return to a more normal and measured way of life and is complex in comparison with other types of assistance. However, it should be emphasized that overcoming the consequences of PTSD is a complicated and lengthy process.

Post-traumatic stress disorder is a complex disease of a psychological nature. Therefore, psychological support and rehabilitation of servicemen is necessary, as it can help restore psychological health and reduce the severity of the consequences of psychological injuries, stressful conditions, and inappropriate behavior outside the combat zone.

Today, the issue of rehabilitation has gained considerable weight, especially for military personnel who defend Ukraine. The countries of the world contribute to the protection of the territory of Ukraine not only by providing military and humanitarian aid, but also by actively cooperating in the issue of rehabilitation, including psychological rehabilitation, both within and outside the borders of our state. This happens by involving Ukrainian psychologists-rehabilitators, and specialists to undergo training, improve their qualifications, acquire new skills, and exchange experience in the leading countries of the world, where the issue of PTSD rehabilitation of servicemen and veterans is provided at a high level.

Introducing new methods, technologies, tools, development of programs, and guidelines for rehabilitating military personnel suffering from post-traumatic mental disorders should be universally accepted. International experience should be especially important for developing and improving the rehabilitation system. International organizations should develop a single, generally accepted mechanism for overcoming the consequences of PTSD, taking into account the practice of countries that are actively working in this direction.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 14.07.2023

ACCEPTED: 03.11.2023



*Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

KURS PT.: „BALNEOLOGIA I MEDYCYNA FIZYKALNA. METODY LECZNICZE ORAZ WYBRANE PROBLEMY Z MEDYCYNY UZDROWISKOWEJ”

W okresie od 27 listopada do 8 grudnia 2023 r. zorganizowaliśmy kolejny kurs balneologiczny dla lekarzy. Był to już 25 kurs balneologiczny organizowany pod moim kierownictwem naukowym. Przez ten okres przeszkolonych zostało ponad 1000 lekarzy, którzy zostali przygotowani przynajmniej w ogólnym zakresie do pracy w zakładach lecznictwa uzdrowiskowego. Kilka ostatnich kursów zostało zorganizowane w sanatorium St. George w Ciechocinku, gdzie obecnie pracuję.

Program obejmował 80 godzin zajęć dydaktycznych w tym 76 godzin wykładowych i 4 godziny ćwiczeń w zakładzie balneologicznym. W części praktycznej lekarze sami przyjmowali zabiegi balneologiczne i fizyoterapeutyczne oraz śledzili technikę ich wykonywania, dzięki temu mogli na sobie spróbować ich działanie.

Celem całego 2-tygodniowego szkolenia było zapoznanie lekarzy pracujących w uzdrowiskach lub innych ośrodkach leczniczych z podstawowymi problemami balneologicznymi i uzdrowiskowymi. Wykłady prowadzone na wysokim poziomie miały zainspirować do dalszej nauki w zakresie medycyny uzdrowiskowej. Znaczna część uczestników nie pracowała jeszcze w uzdrowisku, ale deklarowała chęć w najbliższej przyszłości podjęcia pracy w polskich uzdrowiskach, inni już

pracują w tej dziedzinie, ale chcieli pogłębić swoją wiedzę. W kursie wzięło udział 42 lekarzy z całej Polski. Pochodzili zarówno z uzdrowisk, jak i dużych miast jak Kraków, Warszawa, Bydgoszcz. Uczestnicy stanowili grupę wielospecjalistyczną z różnym stażem lekarskim i w różnym wieku. Reprezentowali prawie wszystkie kliniczne specjalizacje lekarskie, jak: neurologia, ginekologia, medycyna rodzinna, anestezjologia, dermatologia, kardiologia, pediatria, geriatrya, ortopedia, angiologia, interna, chirurgia, nefrologia, urologia, hematologia, onkologia.

Kurs obejmował zagadnienia podstawowe z zakresu geologii uzdrowiskowej, klimatologii, balnechemii, wskazań i przeciwwskazań do leczenia uzdrowiskowego, infrastruktury uzdrowiskowej. Omówiono naturalne surowce lecznicze i czynniki lecznicze wykorzystywane w lecznictwie uzdrowiskowym.

Zapoznano uczestników z wszystkimi najważniejszymi metodami stosowanymi w lecznictwie uzdrowiskowym, jak: balneohydroterapia w tym kąpiele lecznicze i inhalacje, peloidoterapia, balneogazoterapia, hydroterapia, kinezyterapia, ciepło- i zimnolecznictwo, ultrasonoterapia, magnetoterapia, laseroterapia, elektroterapia.

Ponadto przedstawiono wybrane dziedziny kliniczne w aspekcie leczenia uzdrowiskowego, jak: ortopedia,



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reumatologia, nadciśnienie tętnicze, kardiologia, geriatrya, gerontologia, hepatologia, diabetologia. Dodatkowo ciekawy wykład przedstawił prof. David Ferson z USA na temat nowoczesnej metody ćwiczeń fizycznych z ograniczoną okluzją (BFR). Prof. Ferson aktualnie przebywał w Ciechocinku na moje zaproszenie. Ponadto uczestnicy mieli szansę spotkania się z Krajowym Konsultantem w dziedzinie Balneologii i Medycyny Fizykalnej. Pozwoliło to na poznanie zagadnień organizacyjnych uzdrowisk polskich oraz możliwość zadania pytań odnośnie dalszego kierunku rozwoju lecznictwa uzdrowiskowego. Do prowadzenia wykładów zaproszono wybitnych specjalistów, którzy od wielu lat z nami współpracują. Są to pracownicy naukowo-dydaktyczni mający równocześnie specjalizację kliniczną i balneologiczną.

Na zakończenie kursu uczestnicy zobowiązani byli do zdania testu obejmującego 41 pytań jednorazowego wyboru z tematyki poruszanej na kursie. Wszyscy uczestnicy test zdali z wynikiem dobrym i bardzo dobrym, a 1 lekarz uzyskał wynik celujący odpowiadając prawidłowo na prawie wszystkie pytania (prawidłowo odpowiedział na 40 pytań z 41).

Z satysfakcją podkreślam, że uczestnicy wykazywali duże zainteresowanie, pilnie korzystali z zajęć dydaktycznych po wykładach. W przerwach odbywała się ożywiona dyskusja. Uczestnicy kursu mieli też szansę na zakupienie od wydawcy 2-tomowego podręcznika „Wielka Księga Balneologii, Medycyny Fizykalnej i Uzdrowiskowej” oraz Encyklopedii

Balneologii i Medycyny Fizykalnej, dzięki temu będą mogli wiedzę nabytą na kursie utrwalić i poszerzyć. Zgodnie z opinią lekarzy kurs był na bardzo wysokim poziomie, miał charakter interdyscyplinarny i niezwykle ciekawy. Wielu uczestników było zdziwionych szerokim zakresem medycyny uzdrowiskowej. Kilku lekarzy uczestniczących w kursie deklarowało chęć pogłębienia wiedzy w ramach specjalizacji z balneologii i medycyny fizykalnej, chociaż wcześniej tego nie planowali. Dużą zaletą naszych kursów jest prowadzenie zajęć kontaktowo „na żywo”. Pozwoliło to na szeroką dyskusję między lekarzami i z wykładowcami oraz nawiązania kontaktów. Nie obyło się bez dyskusji na tematy medyczne nawet na wspólnej kolacji.

W czasie trwania kursu panowała koleżeńska, pełna życzliwości atmosfera. Wybrany przez uczestników kursu starosta z wielką kulturą i zaangażowaniem integrował grupę lekarzy, przy tym doskonale współpracował z organizatorami kursu. Przed wyjazdem do domów wszyscy wymienili się adresami celem kontynuacji znajomości i współpracy. Kurs zakończono wykonaniem zdjęcia rodzinnego, które załączam.

Dziękuję wszystkim uczestnikom i wykładowcom za zaangażowanie i wytworzenie koleżeńskiej atmosfery, a zwłaszcza Panu Staroście doktorowi A. Wereszczyńskiemu.

**Kierownik naukowy kursu
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