

Correction of musculoskeletal disorders in students of special medical health group 'a' through swimming and water-based muscle strengthening exercises

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Abstract

Musculoskeletal disorders in students are considered one of the most common forms of functional deviations in young age. The majority of students exhibit various forms of posture disorders, including scoliotic posture, increased physiological spinal curvatures, asymmetry of the shoulder girdle and pelvis. Students of special medical group 'A' represent a contingent with functional deviations that do not impede physical education classes but require adaptation of the content and intensity of the load. The main objectives of physical education for this group are the correction of identified deviations, restoration of the functional state of the musculoskeletal system (MSS), and the formation of stable self-control skills.

Objective of the study is to scientifically substantiate and experimentally verify the effectiveness of a comprehensive program for correcting functional musculoskeletal disorders in students of special medical health group 'A,' based on the combined use of swimming and exercises aimed at strengthening the muscular corset, within the process of physical education in a higher educational institution.

Methods and structure of the study. The study was conducted at DSTU from September to December during physical education classes for students of special medical group 'A.'

Results and conclusions. The research results confirm the advisability of a comprehensive approach to organizing classes for students of special medical health group 'A,' wherein swimming and muscle-strengthening exercises are considered not as auxiliary, but as fundamental components of correctional and health-improving work.

Keywords: *students of special medical group, strengthening of the muscular corset, swimming.*

Introduction. The modern stage of higher education development is characterized by a steady decline in the level of physical activity among students against a backdrop of increasing academic, informational, and psycho-emotional load. The predominance of static postures, prolonged work at a computer, use of mobile devices, and insufficient motor compensation lead to the formation of functional musculoskeletal disorders (MSD) already at a young age. According to domestic and foreign authors, 60 to 85% of students have various deviations in posture, muscle tone, and spinal mobility, which is considered a serious medical and social problem of the modern student population [1,5].

A particular risk group consists of students assigned to special medical group "A" based on their health status. This category of learners is characterized by the presence

of functional deviations in various body systems, including the musculoskeletal system, while maintaining the ability for systematic physical education classes provided there is strict dosage and individualization of the load [2]. In students of special medical group (SMG) 'A,' MSD typically have a complex nature and manifest as posture disorders, muscle imbalance, reduced endurance of the trunk stabilizer muscles, and functional pain syndromes.

From the perspective of adapted and therapeutic physical culture, a key task in working with students of special medical group 'A' is not only preventing the progression of identified deviations but also targeted correction of functional MSD, formation of a rational motor stereotype, and increasing the level of postural stability.

In this context, means of physical rehabilitation combining high effectiveness and safety attract particular at-



tention from researchers. One such means is swimming and aquatic exercises, which possess pronounced therapeutic and preventive potential. The physical properties of the aquatic environment – buoyancy, hydrostatic pressure, and resistance – create unique conditions for unloading the spine, activating trunk muscles, and forming symmetrical movement patterns. For example, the authors' study focused on the use of a set of competitive swimming exercises within supplementary education programs for schoolchildren. The developed methodology included the consistent use of general developmental and specialized exercises to master swimming technique, which contributed to strengthening the core muscles [4].

Furthermore, modern scientific literature emphasizes the key role of the muscular corset in ensuring spinal stability and maintaining correct posture. Insufficient functional capacity of the deep stabilizing muscles is considered one of the leading factors in the formation of MSD and pain syndromes.

Swimming is widely used in the system of physical rehabilitation for individuals with MSD. Authors note that the aquatic environment reduces compressive load on the spine, promotes relaxation of overstrained muscles, and simultaneously activates deep trunk stabilizers.

Domestic studies also confirm the advisability of using swimming in the system for correcting MSD. They note that regular swimming sessions contribute to improved posture, increased spinal mobility, and normalization of muscle tone in individuals with functional disorders.

Platonov (2013) emphasizes that combining various forms of motor activity allows for influencing different levels of movement regulation, ensuring more stable adaptive changes. Thus, programs incorporating swimming and water-based exercises for strengthening the muscular corset appear to be the most promising for correcting MSD in students of special medical group 'A' [3].

Objective of the study is to scientifically substantiate and experimentally verify the effectiveness of a comprehensive program for correcting functional musculoskeletal disorders in students of special medical health group 'A,' based on the combined use of swimming and exercises aimed at strengthening the muscular corset, within the process of physical education in a higher educational institution.

Methods and structure of the study. The study was conducted at DSTU from September to December during physical education classes for students of special medical group 'A.' The experiment comprises three interconnected stages:

1. Diagnostic stage – initial examination of students, selection of research participants, formation of control

and experimental groups, conducting baseline diagnostics of musculoskeletal system (MSS) state indicators.

2. Formative stage – implementation of the experimental MSD correction program in the experimental group and conducting traditional classes according to the adapted physical culture program in the control group.

3. Control stage – repeated diagnostics of the studied indicators and comparative analysis of the obtained results.

60 students aged 17-20 were randomly assigned to control and experimental groups of thirty individuals each, comparable in gender, age, and nature of musculoskeletal disorders.

Inclusion criteria for the study: 1. Belonging to special medical health group 'A'; 2. Presence of functional musculoskeletal disorders (posture disorders, muscle imbalance, reduced endurance of trunk muscles); 3. Absence of contraindications to swimming.

The experimental program was developed considering the principles of adapted physical culture: individualization, gradual progression, accessibility, and systematicity. The program combines swimming sessions and the traditional adapted physical culture program provided by the university curriculum.

Structure of sessions for the experimental group:

Sessions are held 2 times per week and include: 1–2 sessions in the pool; 1–2 sessions on land. The duration of one session is 45–60 minutes.

Sessions in the pool include preparatory, main, and concluding parts. Primary focus is on swimming styles that ensure symmetrical muscle work and minimal axial load on the spine (backstroke, adapted front crawl). Elements of aquatic gymnastics and breathing exercises are used.

The control group follows the traditional adapted physical culture program provided by the university curriculum, without targeted use of swimming.

Results of the study and discussion. To comprehensively characterize the functional state of the MSS, the following diagnostic methods were used:

1. Assessment of spinal mobility. Spinal mobility was determined using functional tests (forward, backward, and lateral bends) with measurement of movement amplitude using a centimeter scale. These methods are widely used in the practice of physical therapy and adapted physical culture and possess sufficient informativeness.

2. Assessment of pain syndrome. The intensity of pain sensations in the spinal region was determined using a Visual Analogue Scale (VAS), which allows for quantitative assessment of the subjects' subjective sensations.

Table 1. Spinal Mobility Indicators (cm, $M \pm m$)

Indicator	Group	Before Experiment	After Experiment
Forward Bend	Experimental	6,8 ± 0,4	10,9 ± 0,5
Forward Bend	Control	6,9 ± 0,5	7,8 ± 0,4
Backward Bend	Experimental	3,8 ± 0,3	6,1 ± 0,4
Backward Bend	Control	3,5 ± 0,3	4,2 ± 0,3
Lateral Bend	Experimental	10,5 ± 0,6	14,7 ± 0,6
Lateral Bend	Control	10,7 ± 0,5	11,6 ± 0,5

Table 2. Pain Syndrome Indicators on the VAS Scale (points, $M \pm m$)

Group	Before Experiment	After Experiment
Experimental	4,6 ± 0,3	2,0 ± 0,2
Control	4,5 ± 0,4	3,8 ± 0,3

The research results reflect the dynamics of functional state indicators of the musculoskeletal system in students of special medical health group 'A' during the pedagogical experiment. Data analysis was conducted separately for the control and experimental groups with subsequent comparison of intergroup differences.

At the diagnostic stage, no statistically significant differences between the control and experimental groups on the main studied indicators were revealed ($p > 0.05$), which indicates their initial homogeneity and correct sample formation.

Upon completion of the formative stage, pronounced positive changes were recorded in the experimental group, while in the control group the dynamics were less pronounced or unstable.

1. Changes in spinal mobility (Table 1). The study of spinal mobility revealed positive dynamics in the amplitude of movements in the sagittal and frontal planes among students of the experimental group. The most pronounced changes were recorded during forward and lateral bends, indicating improved elasticity of the muscular-ligamentous apparatus and reduction of muscle tension.

In the control group, the increase in spinal mobility indicators was minimal and in some cases within the margin of measurement error.

2. Dynamics of pain syndrome (Table 2). Analysis of the subjective assessment of pain sensations in the spinal region showed a significant reduction in pain intensity among students of the experimental group. According to the VAS scale, the average pain syndrome values decreased more than twofold.

In the control group, a trend towards reduced pain sensations was also noted; however, these changes were not stable and were less pronounced.

Conclusions. A comprehensive analysis of all studied indicators indicates the high effectiveness of the experi-

mental program based on the combination of swimming and the traditional adapted physical culture program provided by the university curriculum.

The obtained results confirm the advisability of implementing the developed program into the physical education system for students of special medical health group 'A' and indicate the expediency of the combined use of exercises in the aquatic environment and on land. Aquatic therapy programs combined with land-based exercises lead to a more pronounced improvement in postural control compared to the isolated use of individual means.

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