

APPLICATION OF IMPROVING SWIMMING TO THE CORRECTION OF JOINT AND LIGAMENT STUDENTS

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Annotation. The results of research on the state-articular ligaments students engaged in physical education in primary and specialized medical group. In the experiment involved 172 students from three high schools. Identified types of violations of joint and ligaments, and the nature of their manifestations in everyday life. Summarizes the experience of the use of physical culture for the correction of the violations. The expediency of the systematic application of improving swimming. The author's use of improving swimming technique to correct the negative manifestations. To correct the violations are offered several ways to swim. Dosing load is proposed to segment long swims, intensity, swimming way, the number of breaths in the water between the segments, alternating with the exercises on the spot, lasting lessons.

Keywords: articular, ligamentous, apparatus, recreation, swimming, correction of violations, students, special medical group.

Introduction

Systemic studies of health of our planet's population show that during recent years there have been increasing the quantity of diseases of supporting motor system. As per the data of world health protection organization every fifth inhabitant of our planet has articulations' disorders or complains on pains in legs or their restricted mobility [5]. This pathology among students is of special trouble. Students are special group of risk; they are influenced by negative environmental conditions and suffer from different diseases oftener than other social groups [12, 17].

Abnormalities of students' supporting motor system are noted by specialists in many HEEs of Russian Federation (RF) and, by data of researches, they are 15.2% in Ulyanovsk state university [15]. Abnormalities of supporting motor system take one of leading places in National research university (NRU) of "BelGU". According to researches, in 2008-09 academic year they were 34.7%, in 2009-10 academic year– 30.2%, in 2010-11–35.3%. Among all abnormalities of supporting motor system, about 10% are disorders of articulations-ligaments system. Such disorders restrict every day motion activity of students that results in defective socialization of student's personality, aggravation of 17-years old crisis and causes in-personal conflict, connected with non-compliance of current reality with the set life targets. Besides, disorders in articulations-ligaments system limit professional choice and can result in disability [3, 6, 11].

Thus, in connection with availability of students' disorders of articulations-ligaments system, the problem of development of new, targeted to certain nosological group, methodic of systemic application of health related physical culture has become rather urgent, meaning application of such means within academic educational process on discipline "Physical culture" at special department of HEE.

The article has been prepared by results of work at project №6.2093.2011 "Kinesio-therapy in HEE students' health protection system", which had been fulfilled within frames of State task of Ministry of education and science of Russia for scientific & research works to subordinated HEEs.

Purpose, tasks of the work, material and methods

The purpose of the research is to scientifically ground methodic of application of health related swimming at academic trainings in physical culture with students of special health groups, who have disorders of articulations-ligaments system.

The purpose of the work was achieved by solving of the following *tasks*:

1. Determination of special health group students' articulations-ligaments disorders' types and character of their manifestation in every day life; generalization of existing experience of physical culture means' application for correction of such disorders.
2. Foundation of purposefulness of health related swimming's systemic application at academic trainings on physical culture with students of special health groups, who have articulations-ligaments system's disorders.
3. Development of methodic of health related swimming's application at academic trainings on physical culture with students of special health groups, who have articulations-ligaments system's disorders, and testing of its effectiveness.

The methods of the research: theoretical analysis and generalization of data of special literature; questioning; analysis of academic documentation; anthropometric examinations; testing; method of indices; method of goniometry; pedagogical experiment; method of mathematical statistics.

Results of the researches

Articulations-ligaments system (ALS) is an active part of human supporting motor system (SMS), ensuring conscious purposeful movements and motion activity in general. Articulation diseases result in disease of cartilage, inflammation of articular corpuscles that, in their turn, result in ALS disorders of different types. Lower limbs' joints are most sensitive for diseases, because they are under constant load of body mass. ALS disorders affect active SMS part, depriving person of possibility to experience active, full fledged life style, worsening organism's functional state and facilitating progressing of new diseases [5, 7, 8, 10, 16].

After analytical review of physical culture means, applied for correction of ALS disorders, we came to conclusion that in the opinion of most of specialists the most purposeful is using of health related properties of water medium [5, 9, 13, 14,]. However, we did not find scientifically grounded methodic of application of health related swimming at academic physical culture trainings (AT) with special health group students (SHG), who have ALS disorders.

Goniometry results showed that SHG students with ALS disorders have restricted amplitude of big joints' movement of upper and lower limbs. By these indicators they confidently differ from SHG students of other nosologies (see table 1-2).

Table 1

Mobility of big joints of different health groups' boys by results of goniometry (MHG n=63; SHG n=76; ALSSG n=33)

Indicators			MHG	SHG	ALSSG	P	P	P
			M ± m	M ± m	M ± m	mhg-shg	mhg-alssg	shg-alssg
Shoulder joint	Bending (Norm: 180°)	left	172.86 ± 1.83	162.86 ± 3.46	126.43 ± 7,45	*	***	*
		right	177.86 ± 1.09	162.14 ± 4.30	138.86 ± 6,68	*	***	*
	Unbending (Norm: 40°)	left	41.43 ± 0.47	37.14 ± 0.94	32.14 ± 2,07	*	*	*
		right	39.29 ± 0.66	36.43 ± 0.92	29.29 ± 1,88	*	***	***
	Side movement (Norm: 180°)	left	179.29 ± 0.87	148.57 ± 5.90	122.86 ± 6,71	***	***	*
		right	178.57 ± 0.73	155.71 ± 4.25	140.0 ± 7,78	***	*	
Rotation (Norm: 40°)	left	39.29 ± 0.36	36.43 ± 1.07	33.57 ± 2,13	*	*		
	right	40.71 ± 0.66	35.00 ± 1.11	27.86 ± 2,28	*	***	*	
Elbow joint	Bending (Norm: 40°)	left	39.29 ± 0.66	42.14 ± 0.94	55.00 ± 3,19	*	*	***
		right	40.00 ± 0.79	43.57 ± 0.73	49.29 ± 2,45	*	*	*
	Unbending (Norm: 180°)	left	179.29 ± 1.03	178.14 ± 0.91	176.14 ± 1,25			
		right	176.43 ± 0.73	179.29 ± 0.66	177.29 ± 1,34	*		
	Supination (Norm: 180°)	left	175.00 ± 1.11	176.86 ± 0.72	175.43 ± 1,13			
		right	175.00 ± 0.79	177.29 ± 0.93	180.43 ± 0,31		***	***
Pronation (Norm: 180°)	left	174.43 ± 1.20	178.71 ± 0.73	175.29 ± 0,96	*		*	
	right	177.43 ± 0.38	175.29 ± 0.96	173.86 ± 1,56		*		
Wrist joint	Bending (Norm: 75°)	left	72.86 ± 0.56	73.71 ± 0.56	72.57 ± 0,4			
		right	76.43 ± 0.58	74.86 ± 0.56	73.57 ± 0,58		*	
	Unbending (Norm: 65°)	left	65.43 ± 0.60	64.14 ± 0.42	62.00 ± 0,53		***	*
		right	64.43 ± 0.47	63.14 ± 0.46	63.29 ± 0,66			
	Radial side movement (Norm: 20°)	left	19.29 ± 0.38	21.86 ± 0.44	19.43 ± 0,37	*		***
		right	19.71 ± 0.33	20.14 ± 0.36	19.86 ± 0,53			
Ulnar side movement (Norm: 40°)	left	40.86 ± 0.45	39.00 ± 0.50	38.86 ± 0,53	*	*		
	right	40.29 ± 0.45	39.71 ± 0.35	40.29 ± 0,33				
Hip joint	Bending (Norm: 75°)	left	73.00 ± 0.57	76.43 ± 1.33	90.00 ± 3,33	*	*	*
		right	73.14 ± 0.51	75.29 ± 1.06	90.71 ± 2,8		***	***
	Side movement (Norm: 50°)	left	52.43 ± 0.46	47.86 ± 1.40	40.00 ± 1,47	*	***	*
		right	52.71 ± 0.41	52.71 ± 0.93	44.14 ± 1,18		***	***
Rotation (Norm: 40°)	left	38.43 ± 0.77	37.29 ± 0.90	31.43 ± 1,98		*	*	
	right	39.00 ± 0.74	35.86 ± 0.51	35.29 ± 1,23	*	*		
Knee joint	Bending (Norm: 40°)	left	41.14 ± 0.45	42.86 ± 1.47	59.71 ± 4,19		*	*
		right	40.43 ± 0.47	43.00 ± 1.51	58.86 ± 3,45		***	***
	Unbending (Norm: 180°)	left	179.43 ± 0.48	179.29 ± 0.82	179.57 ± 0,52			
		right	179.57 ± 0.41	178.71 ± 0.79	179.0 ± 0,48			
Ankle joint	Bending (Norm: 130°)	left	129.43 ± 0.48	125.29 ± 1.61	121.43 ± 2,13	*	*	
		right	128.57 ± 0.29	125.43 ± 1.50	121.14 ± 1,89		*	

	Unbending (Norm: 70°)	left	70.00 ± 0.38	71.71 ± 0.84	73.00 ± 1,06		*	
		right	68.86 ± 0.30	72.29 ± 0.87	72.43 ± 1,03	*	*	

*- differences are confident by Student's criterion ($P \leq 0.05$)

** - differences are confident by Fisher's criterion ($P \leq 0.05$)

*** - differences are confident by Student's and Fisher's criteria ($P \leq 0.05$)

Table 2

*Mobility of big joints of different health groups' girls by results of goniometry
(MHG n=53; SHG n=64; ALSSG n=35)*

Indicators			MHG	SHG	ALSSG	P	P	P
			M ± m	M ± m	M ± m	mhg-shg	mhg-alssg	shg-alssg
Shoulder joint	Bending (Norm: 180°)	left	178.87 ± 0.36	179.52 ± 0.49	169.70 ± 4.95		***	**
		right	179.00 ± 0.41	179.48 ± 0.64	169.13 ± 4.26	**	***	***
	Unbending (Norm: 40°)	left	40.57 ± 0.43	38.74 ± 0.59	36.70 ± 1.25	*	*	**
		right	41.17 ± 0.45	39.74 ± 0.45	36.91 ± 1.39	*	**	**
	Side movement (Norm: 180°)	left	179.74 ± 0.43	178.52 ± 0.56	171.30 ± 3.85		**	**
		right	180.52 ± 0.38	178.74 ± 0.56	171.09 ± 3.84	*	**	**
	Rotation (Norm: 40°)	left	40.61 ± 0.42	39.30 ± 0.38	34.04 ± 1.19	*	***	***
		right	40.74 ± 0.38	39.83 ± 0.39	34.70 ± 1.10		***	***
Elbow joint	Bending (Norm: 40°)	left	40.61 ± 0.33	43.26 ± 0.87	42.65 ± 0.92	***	**	
		right	39.83 ± 0.24	41.17 ± 0.56	43.04 ± 0.77	***	***	
	Unbending (Norm: 180°)	left	180.65 ± 0.41	178.30 ± 0.78	181.70 ± 0.59	***		*
		right	181.00 ± 0.46	179.09 ± 0.76	181.26 ± 0.51	***		*
	Supination (Norm: 180°)	left	179.96 ± 0.45	178.13 ± 0.75	166.13 ± 3.15	**	***	***
		right	179.17 ± 0.56	177.30 ± 1.04	169.74 ± 3.17	**	**	***
	Pronation (Norm: 180°)	left	179.00 ± 0.80	177.74 ± 1.01	175.96 ± 0.81		*	
		right	179.74 ± 0.37	178.74 ± 0.69	176.39 ± 0.71	**	*	*
Wrist joint	Bending (Norm: 75°)	left	75.04 ± 0.58	72.26 ± 1.10	64.78 ± 2.90	***	***	***
		right	75.35 ± 0.59	72.61 ± 1.41	65.09 ± 2.93	**	***	***
	Unbending (Norm: 65°)	left	64.83 ± 0.48	63.65 ± 0.38	56.70 ± 2.62		***	***
		right	65.17 ± 0.47	63.48 ± 0.45	57.04 ± 2.60	*	***	***
	Radial side movement (Norm: 20°)	left	19.78 ± 0.33	20.43 ± 0.45	19.61 ± 0.31			
		right	20.13 ± 0.30	19.91 ± 0.30	19.91 ± 0.33			
	Ulnar side movement (Norm: 40°)	left	40.22 ± 0.55	39.78 ± 0.42	38.13 ± 0.82		**	**
		right	39.52 ± 0.46	39.35 ± 0.36	37.00 ± 1.26		**	**
Hip joint	Bending (Norm: 75°)	left	75.65 ± 0.46	76.74 ± 1.16	78.48 ± 1.55	**	**	
		right	75.17 ± 0.38	77.57 ± 1.41	80.30 ± 1.87	**	***	
	Side movement (Norm: 50°)	left	51.78 ± 0.45	49.78 ± 0.91	46.26 ± 1.09	**	***	*
		right	52.43 ± 0.38	49.43 ± 1.14	47.52 ± 0.77	***	***	
	Rotation (Norm: 40°)	left	41.00 ± 0.22	39.00 ± 0.65	37.74 ± 1.27	***	**	**
		right	40.83 ± 0.41	39.39 ± 0.42	38.91 ± 0.8	*	**	**
Knee joint	Bending (Norm: 40°)	left	39.96 ± 0.27	40.48 ± 0.38	60.83 ± 3.72		*	***
		right	40.09 ± 0.32	41.91 ± 1.11	59.70 ± 3.02	**	***	***
	Unbending (Norm: 180°)	left	181.30 ± 0.42	181.04 ± 0.34	179.78 ± 0.47		*	
		right	180.96 ± 0.44	180.78 ± 0.31	179.00 ± 0.44		*	*
Ankle joint	Bending (Norm: 130°)	left	130.09 ± 0.33	126.39 ± 1.02	121.96 ± 1.83	***	***	**
		right	129.91 ± 0.32	126.48 ± 1.13	121.74 ± 1.64	***	***	*
	Unbending (Norm: 70°)	left	69.52 ± 0.32	72.43 ± 0.83	72.91 ± 0.9	***	***	
		right	69.87 ± 0.30	72.96 ± 0.84	72.30 ± 0.87	***	***	

*- differences are confident by Student's criterion ($P \leq 0.05$)

** - differences are confident by Fisher's criterion ($P \leq 0.05$)

*** - differences are confident by Student's and Fisher's criteria ($P \leq 0.05$)

All above mentioned conditioned necessity in development of author's methodic of health related swimming's application at physical culture AT with SHG students of the mentioned nosology. The methodic was developed in compliance with annual academic plan, approved by state program, which envisaged 136 hours a year for physical culture.

When selecting exercises and methods of swimming, we based on principles of motion regime for articulation diseases, recommended by most of specialists: exclusion of movements, which cause pain; exclusion of expressed muscular efforts, i.e.: run, jumps,, exercises with complex coordination. Correlation of physical and breathing exercises is 1:3 and 1:4. In this connection, warming up part out of water included walking and exercises of general development (GDE) (from 5 to 12 exercises and more, 5-8-12 repetitions) from different initial positions; exercises were composed on the base of therapeutic physical culture for the given nosology.

Thus, for correction of ALS of SHG students there were proposed the following methods of swimming: with plank in hands, working only by legs; crawl on breast, crawl on side, crawl on back, dolphin; with small plank, pressed between legs (working only by arms): breaststroke, crawl on back;; combined methods, working by legs and arms simultaneously: arms work in breaststroke style – legs – in crawl on breast style; arms in breaststroke style – legs in dolphin style. Complex of exercises in water was oriented on improvement of organism's functional state.

Dosing of load was regulated by the length of segment, to be covered in swimming, intensity, method of swimming, quantity of exhales in water between segments, alternating of exercises on spot, duration of training.

Warming up (out of water, 10 minutes) is: preparation of organism for coming physical load, restoration of joints' mobility. Content of warming up AT part is p[resented in table 3.

Main part of training (in water, 40-50 minutes) includes: restoration of joints' mobility, correction of functional state of organism. At first and last trainings in water control timing was carried out (12 minutes' Cooper's test) for comparing of indicators of general endurance of the tested.

Final part of training (in water, 5-10 minutes) is: restoration of organism after load. Final part consisted of three parts: jumps in water, static swimming on breast and back, breathing exercises.

Pedagogical; experiment for testing of effectiveness of experimental methodic was carried out at department of physical education No.1 of NRU "BelGU". It covered 1-3 year students of 17-20 years old age, with disorders of ALS and included in SNG groups. 6 groups were formed: 2 experimental, 2 half experimental and 2 control groups. In experimental groups (EG) students were trained strictly by experimental methodic. In half-experimental groups (HEG) students fulfilled warming up together with EG students, but in main and final part they practices swimming by methods, which they chose as per their self-feeling. Total scope of swimming per one training was equal for EG and HEG. In control group physical culture trainings were conducted as per program of physical education, developed and approved at department of physical education No.1 of NRU "BelGU" for all SHG students. Among ALS disorders of the tested the most frequent were: gonarthrosis, coxarthrosis, osteoarthrosis deformans of 1 and 2 degree, post-traumatic arthrosis of big joints. Medical control during experiment was carried out in compliance with requirements for special health groups – two times a year.

Diagnosis of CVS functional state of the tested was fulfilled with the help of functional indices of Li and Trofimov and with goniometry method. Dynamics of boys' and girls' indicators before and after experiment is presented in table 3.

Table 3

Indicators of functional indices of boys and girls before and after pedagogical experiment

Indicators	Order of testing	EGg (n=18)	HEGg (n=17)	CGg (n=20)	P	P EGg- HEGg	P EGg-CGg	P HEGg-CGg
		M ± m	M ± m	M ± m				
Li index (points)	before	2.7 ± 0.17	2.9 ± 0,31	2.86 ± 0,2	*			
	after	1.22 ± 0.17	1.4 ± 0,16	2.36 ± 0,13				
Trofimov's index (points)	before	3.39 ± 0.14	3.1 ± 0,23	2.77 ± 0,16	*			
	after	0.87 ± 0.14	1.7 ± 0,15	2.45 ± 0,15				
Indicators	Order of testing	EGb (n=12)	HEGb (n=11)	CGb (n=13)	P	P EGb- HEGb	P EGb-CGb	P HEGb-CGb
Li index (points)	before	2.71 ± 0.39	2.2 ± 0.16	2.23 ± 0,16				
	after	1.07 ± 0.18	1.14 ± 0.13	1.75 ± 0,17				
Trofimov's index (points)	before	2.86 ± 0.35	2.07 ± 0.18	2.07 ± 0,21	*			
	after	0.86 ± 0.17	1.67 ± 0.19	1.85 ± 0,15				

*- differences are confident by Student's criterion (P≤0.05)

** - differences are confident by Fisher's criterion ($P \leq 0.05$)

Indicators of Li-functional index confidently improved at EG and HEG ($p \leq 0.05$). Trofimov's functional index became confidently better at EG group ($p \leq 0.05$), than at HEG and CG. From here it is evident that trainings by experimental methodic facilitated reduction of pain of EG boys and girls with fulfilling by them ordinary actions in domestic life.

After experiment, as per results of goniometry, joints' mobility of all tested improved, that proves usefulness of physical trainings for maintaining and improvement of CVS functional state (see tables 4-5). But majority of confident positive changes took place at EG (boys and girls).

Table 4
Dynamics of mobility of girls' upper limbs joints of EGg (n=18), HEGg (n=17) and CGg (n=20) before and after experiment (in degrees)

Indicators	Order of testing	EGg		P	HEGg		P	CGg		P	P EG-HEG	P EG-CG	P HEG-CG
		M ± m			M ± m			M ± m					
Shoulder joint	bending	left	before	166.70 ± 4.95	**	168.60 ± 5.98	**	169.09 ± 5.98	**				
			after	175.52 ± 0.92		174.60 ± 2.63		175.82 ± 1.93	**	**			
		right	before	169.13 ± 4.26	**	170.00 ± 6.58	**	168.64 ± 5.15	**				
			after	176.22 ± 0.77		176.50 ± 2.48		177.41 ± 1.62	**	**			
	Unbending	left	before	36.70 ± 1.25	**	35.60 ± 2.22	**	37.00 ± 1.48	**				
			after	38.65 ± 0.52		38.10 ± 1.19		38.68 ± 0.73	**				
		right	before	36.91 ± 1.39	**	35.20 ± 2.77	**	36.77 ± 1.68	**				
			after	38.04 ± 0.41		37.20 ± 1.65		39.09 ± 0.66	**	**		**	
	Side movement	left	before	171.30 ± 3.85	**	171.10 ± 6.89	**	170.91 ± 4.65	**				
			after	176.52 ± 0.88		176.60 ± 1.73		178.73 ± 0.72	**		**	**	
		right	before	171.09 ± 3.84	**	168.50 ± 7.88	**	170.77 ± 4.66	**				
			after	177.35 ± 0.66		174.00 ± 3.45		178.68 ± 0.70	**	**		**	
rotation	left	before	34.04 ± 1.19	***	32.40 ± 2.17		34.23 ± 1.43						
		after	39.13 ± 0.25		33.60 ± 1.71		34.23 ± 1.57		***	*			
	right	before	34.70 ± 1.10	***	33.60 ± 2.02		34.55 ± 1.33						
		after	39.00 ± 0.61		34.70 ± 1.56		35.91 ± 1.34		*	*			
Hip joint	bending	left	before	78.48 ± 1.55	**	84.50 ± 3.77	**	78.68 ± 1.87					
			after	75.90 ± 0.41		81.20 ± 1.94		77.09 ± 1.40		***			
		right	before	80.30 ± 1.87	**	86.40 ± 4.36	**	80.59 ± 2.25					
			after	76.81 ± 0.53		81.60 ± 2.25		77.95 ± 1.71		**			
	Side movement	left	before	46.26 ± 1.09	***	42.40 ± 2.34		46.09 ± 1.31					
			after	48.78 ± 0.46		43.40 ± 2.20		49.86 ± 1.13		***		*	
		right	before	47.52 ± 1.77	**	42.80 ± 1.67		47.41 ± 1.92					
			after	48.48 ± 0.43		43.60 ± 1.54		49.50 ± 1.42		***		*	
	Unbending	left	before	37.74 ± 1.27	**	32.60 ± 2.82		37.64 ± 1.53					
			after	39.96 ± 0.26		34.20 ± 2.17		36.95 ± 1.29		***	*		
		right	before	38.91 ± 1.80	**	33.30 ± 2.33		38.86 ± 1.97					
			after	39.57 ± 0.22		35.00 ± 2.03		37.68 ± 1.21		***			

* - differences are confident by Student's criterion ($P \leq 0.05$)

** - differences are confident by Fisher's criterion ($P \leq 0.05$)

*** - differences are confident by Student's and Fisher's criteria ($P \leq 0.05$)

Table 5

Dynamics of mobility of boys lower limbs joints of EGb (n=12), HEGb (n=11) and CGb (n=13) before and after experiment (in degrees)

Indicators			Order of testing	EGb	P	HEGb	P	CGb	P	P	P	P	
				M ± m		M ± m		M ± m		EG-HEG	EG-CG	HEG-CG	
Shoulder joint	bending	left	before	126.43 ± 7.45	*	127.33 ± 9.29		133.61 ± 8.43					
			after	155.57 ± 6.65		137.20 ± 8.56		134.62 ± 8.25					
		right	before	138.86 ± 6.68		138.93 ± 7.99		138.61 ± 6.73					
			after	167.57 ± 2.01	***	142.13 ± 7.86		136.46 ± 8.05	***	*			
	Unbending	left	before	32.14 ± 2.07		31.00 ± 2.81	**	32.39 ± 2.45					
			after	37.00 ± 0.78	***	36.33 ± 1.24		33.08 ± 2.80					
		right	before	29.29 ± 1.88		29.67 ± 2.36		31.17 ± 2.12					
			after	34.14 ± 1.06	***	33.00 ± 1.75		30.00 ± 2.59					
	Side movement	left	before	122.86 ± 6.71		122.00 ± 8.38		129.44 ± 8.09					
			after	151.57 ± 5.21	*	142.53 ± 7.52		131.46 ± 8.46					
		right	before	140.00 ± 7.78		142.67 ± 10.02		135.39 ± 7.74					
			after	165.71 ± 3.25	***	146.67 ± 9.29		133.46 ± 10.09	**	*			
rotation	left	before	33.57 ± 2.13		32.33 ± 2.92		31.00 ± 2.56						
		after	38.57 ± 0.47	**	33.67 ± 2.46		33.08 ± 3.02						
	right	before	27.86 ± 2.28		28.67 ± 2.95		28.17 ± 2.48						
		after	34.00 ± 1.57	*	30.00 ± 2.63		28.85 ± 3.11						
Hip joint	bending	left	before	90.00 ± 3.33	***	89.67 ± 4.13		88.17 ± 3.53					
			after	81.00 ± 1.37		84.67 ± 3.22		91.54 ± 4.54	**	*			
		right	before	90.71 ± 2.80		90.00 ± 3.55		88.06 ± 3.13					
			after	84.86 ± 2.13		86.40 ± 2.75		91.92 ± 3.82					
	Side movement	left	before	40.00 ± 1.47		40.67 ± 1.94		39.17 ± 1.81					
			after	44.57 ± 0.85	***	42.67 ± 1.75		40.77 ± 1.95					
		right	before	44.14 ± 1.18		44.2 ± 1.46		42.61 ± 1.50					
			after	45.00 ± 0.97		44.53 ± 1.40		43.69 ± 1.63					
	Unbending	left	before	31.43 ± 1.98		32.00 ± 2.53		31.78 ± 2.12					
			after	37.14 ± 0.53	***	33.60 ± 2.05		31.15 ± 2.84	**				
right		before	35.29 ± 1.23		35.27 ± 1.52		34.50 ± 1.35						
		after	37.43 ± 0.48	**	36.80 ± 0.73		34.92 ± 1.72						

*- differences are confident by Student's criterion (P≤0.05)

** - differences are confident by Fisher's criterion (P≤0.05)

***- differences are confident by Student's and Fisher's criteria ($P \leq 0.05$)

Analysis of results of pedagogical experiment on testing of experimental health related swimming's efficiency in its application at physical culture AT with SHG students, having ALS disorders, permitted to prove purposefulness of its application for correction of disorders, improvement of organism's functional state and general level of somatic health.

Conclusions:

Analysis of special literature showed that in RF HEEs there exists noticeable decreasing of students' health level, as a result of which, at present, about 40-45% of students are members of SHG groups by results of annual medical examinations. With it, about 10% of students have disorders of articulations-ligaments system.

1. Specialists regard therapeutic physical culture, articulation gymnastics, complex influence of physical exercises, massage and physio-therapy, mechanical therapy, vibration stimulation, electric acupuncture, mud therapy, health related outdoor games, herbal therapy, yoga exercises, rowing and bicycle simulators, health related and therapeutic swimming to be effective means of health-correction for persons, having disorders of articulations-ligaments system. With it great majority of specialists regard just swimming, as a key correction mean for disorders of articulations-ligaments system; as well they note that it is necessary to avoid pain sensations in the process of training and refusal of power exercises.

2. Such exercises as run, walking, walking up-downstairs, squatting are difficult and cause pain for most of students with disorders of articulations-ligaments system. By goniometry results, students of such nosology have restricted amplitude of movements of upper and lower limbs' big joints with confident difference from SHG students of other nosologies and from students of main health group ($p \leq 0.05$ by criteria of Student and Fisher).

3. By a number of functional state indicators, students with disorders of articulations-ligaments system have confidently less favorable results than SHG students of other nosologies or students of main health group. Girls have confidently weaker vegetative indicators ($p \leq 0.05$); indicators of organism's oxygen-transportation abilities ($p \leq 0.05$) and physical workability ($p \leq 0.05$). Boys have weaker indicators of organism's aerobic abilities ($p \leq 0.05$), efficiency of myocardium functioning ($p \leq 0.05$), BP ($p \leq 0.05$), organism's resistance to hypoxia ($p \leq 0.05$).

4. As main mean of correction of special health group students' disorders of articulations-ligaments system it is purposeful to use the created methodic of health related swimming's application, which includes passing of certain distances with specially trained swimming styles, combined with in-water exercises. Effectiveness of this methodic has been proved by confident improvement of big joints' mobility of experimental group students in the course of pedagogical experiment. Experimental group girls have confidently more favorable indicators of amplitude of shoulder joints' movement (side movement, rotation), of elbow movement (supination), wrist joints (bending), hip joints (rotation), knee joints (bending), ankles (bending-unbending) in comparison with half experimental and control groups students, by results of control and final testing. Experimental group boys have more favorable indicators of shoulder joints' movement (side movement, rotation), knee joints (bending), hip joints (rotation, bending), ankles (bending-unbending). Differences are confident by Student's and Fisher's criteria ($P \leq 0.05$).

5. With the help of functional indices of Li and Trofimov, it was found that experimental group students gained reduction of difficulty in fulfillment of simple action in domestic life ($p \leq 0.05$); besides, they have improved functions of external breathing ($p \leq 0.05$), organism's aerobic abilities ($p \leq 0.05$), physical ($p \leq 0.05$), general endurance ($p \leq 0.05$), power potential ($p \leq 0.05$).

Thus, pedagogic experiment proved our hypothesis and permitted to formulate the presented above conclusions, which completely meet the tasks of our research.

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