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THE DEVELOPMENT OF FUNCTIONAL RESERVES OF CARDIOVASCULAR SYSTEM DURING THE COMBINED INFLUENCE OF AEROBIC-ANAEROBIC PHYSICAL TRAINING AND BREATHING EXERCISES OF LYCÉE STUDENTS

Мета роботи: встановити поєднаний вплив аеробно-анаеробних фізичних навантажень і дихальних вправ на функціональні резерви серцево-судинної системи юнаків. 35 юнаків віком 14 років займалися протягом 1,5 року за розробленою системою занять фізичною культурою з використанням дихальних вправ. Встановлено, що в кожній частині заняття фізичне навантаження викликає функціональні зміни серцево-судинної системи. Підвищення функціональних резервів системи кровообігу зафіксовано при виконанні динамічних вправ в аеробно-анаеробному режимах. У поєднанні з дихальними вправами вони прискорюють відновні процеси і створюють умови для вдосконалення адаптаційно-компенсаторних реакцій організму. Зміна потужності роботи, характеру м'язових скорочень та положення тіла під час виконання вправ сприяють посиленню відновних процесів і є фізіологічною основою для підвищення оздоровчого ефекту занять фізичною культурою.

Ключові слова: *юнаки, дихальні вправи, серцево-судинна система.*

Цель работы: установить сочетанное влияние аеробно-анаэробных физических нагрузок и дыхательных упражнений на функциональные резервы сердечно-сосудистой системы юношей. 35 юношей возрастом 14 лет занимались на протяжении 1,5 года по разработанной системе занятий физической культурой с использованием дыхательных упражнений. Установлено, что в каждой части занятия физическая нагрузка вызывает функциональные изменения сердечно-сосудистой системы. Повышение функциональных резервов системы кровообращения зафиксировано при выполнении динамических упражнений в аеробно-анаэробном режимах. В сочетании с дыхательными упражнениями они ускоряют восстановительные процессы и создают условия для совершенствования адаптационно-компенсаторных реакций организма. Изменение мощности работы, характера мышечных сокращений и положения тела во время выполнения упражнений способствуют усилению восстановительных процессов и являются физиологичной основой для повышения оздоровительного эффекта занятий физической культурой

Ключевые слова: *юноши, дыхательные упражнения, сердечно-сосудистая система.*

Purpose of work: to set associativ influence of the аеробно-anaerobic physical loadings and respiratory exercises on functional backlogs of the cardio-vascular system of youths. 35 youths 14 years were engaged in age during 1,5 year on the developed system of employments by a physical culture with the use of respiratory exercises. It is set that in every part of employment the physical loading causes the functional changes of the cardio-vascular system. The increase of functional backlogs of the system of circulation of blood is fixed at implementation of dynamic exercises in аеробно-anaerobic modes. In combination with respiratory exercises they accelerate restoration processes and create terms for perfection of adaptation-compensating reactions of organism. Change of power of work, character of muscle reductions and position of body during implementation of exercises is instrumental in strengthening of restoration processes and are physiology basis for the increase of health effect of employments by a physical culture

Keywords: *youngeters, aerobic-anaerobic physical loadings, respiratory exercises, functional backlogs, cardio-respiratory system.*

Formulation of the problem and analysis of the last researches' results. The functional backlogs of the organism effect the level of physical efficiency, which, in most cases, is determined by the state of the cardio-respiratory system [1, 3]. Unlike the static, the dynamic work depends on the effectiveness of energy supply mechanism and requires the support of necessary level of metabolic processes. This causes the need of the significant activation of functions of other organs, in particular, respiratory [5]. It is known that the triple increase of metabolism causes the expressed anoxia, as the safety coefficient to transfer the oxygen is 3 units [2, 3, 6]. In case of intensive physical loading the coefficient of recycling oxygen increases in 3 times, while a minute volume of blood may increase comparatively

with the state of rest in 6 times. As a result, the blood supply increases in about 18 times. For trained people such increase of power gives a chance to increase the level of metabolism in 15–20 times comparatively with a level of a main reciprocity [8, 9]. It indicates the expediency of regular trainings with the priority to do breathing exercises, which help to increase the level of reciprocity processes, which rises with the increase of the physical loading level. Under the influence of systematic breathing exercises the complex of structural-functional changes develops in the organism, which are aimed at optimization the function of whole organism, and it's single systems. The cardio-respiratory system is not exception, because it's optimization to function is necessary to achieve a high level of somatic health [3,6,9].

The experimental confirmation about the efficiency of influence on the cardio-respiratory system was gained by the health-training system of respiratory gymnastics (CRS), which was developed by us [8]. However, conducted researches did not give possibility to define laws and features of influence on the system of circulation of blood of different by a form and power physical loadings with their certain sequence during the exercise.

Purpose of work – to define the combined influence of aerobic-anaerobic physical loadings and respiratory exercises on the functional backlogs of cardiovascular system of youngsters.

Methods and organization of research. In the researches 35 youngsters by the age of 14 years old took part, who have been training by the developed system for 1,5 year. The duration of each exercise is 60 min. The introductory part (10 min. limbering-up) consists of different kinds of walk, slow run, movement exercises and dance moves. In the first half of a basic part (10–30 min.) the physical exercises from starting position standing up and dynamic loading to all groups of muscles by current method were done, which were combined with respiratory exercises with the increase of exhale duration. In the period from 30 to 50 min. the physical exercises were done to all groups of muscles from starting position sitting, lying, kneeling and static loading combined with respiratory exercises and influence on different phases of breathing. In the final part of exercise (from 50 to 60 min.) the static loadings on stretching in a position by lying on back combined with relaxing and respiratory exercises were done.

The dynamics of basic hemodinamic indexes (frequency of cardiac reductions – FCR, APds APd), and also sistolic (SV) and the minute volume of blood stream (MVBS) were studied during the whole exercise, in a state of rest in horizontal and vertical positions of body, after every part of exercise, right away after the exercise and during renewal.

For the analysis of rhythm of heart the method of variation of to measure a pulse was used [1,4,5,8]. The variational pulsogram was written down on 12 channel electrocardiograph Kettler in the second standard taking by the program "CardioLab+". Continuous registration of 100 cardiocycles was conducted with the count of the R-R intervals. For the analysis of the rhythm of heart were determined indexes which characterize the level of functioning of cardiosystem: Mode (Mo), amplitude of Mode (AMo%), and also indexes which determine the degree of variation – maximal (MxRR) and minimum (MnRR) amplitudes of cardiointervals, a variation scope (ΔRR) and derivative index, which is the index of tension of the regulator systems (ITRS) [4].

All indexes are treated by the method of nonparametric statistics [7].

Research results. Before the beginning of the exercises in horizontal position of body the FCR indexes are 61,9±2,83 уд/min., in vertical – 75,3±2,95 уд/min, the indexes of systolic and diastolic AP – accordingly 121,5±1,63/56,7±2,05 and 110,5±2,31/69,7±3,51 mm. merc. col (table 1).

Table 1

The indexes of hemodynamics in rest and after loading during the exercise (M±m, n=35)

Parts of exercise	FCR, shots in a minute	APs, mm. merc. col.	APd, mm. merc. col.	SV, ml	MVBS, l/min
Before the exercise (lying)	61,9±2,81	121,5±1,63	56,7±2,05	80,4±2,28	4,6±0,22
Before the exercise (standing)	75,2±2,94	110,5±2,31	69,7±3,51*	62,5±2,51*	4,3±0,21
0–10 min.	112,8±2,32*	160,6±3,58*	64,8±3,22	94,1±1,65*	14,2±0,66*
10–30 min	145,3±3,41*	182,8±3,52	59,5±1,53	108,8±3,48*	19,9±1,31*
30–50 min.	105,1±4,99*	165,5±2,44	68,7±2,39*	92,9±3,82	12,6±0,96*
50–60 min.	61,9±2,65*	114,7±1,66*	59,6±1,67*	76,7±2,11*	4,5±0,23*
In 2 min. after the exercise	73,1±2,43	112,3±2,75	68,3±2,61	67,9±2,76	5,1±0,65

Note: *p<0,05 – likely changes compared with previous indexes.

The changes of position of body influenced on the SV and MVBS indexes. In horizontal position of the body SV makes 80,4±2,28 ml, and in vertical – diminishes on 33,2±0,32% and is evened 62,5±2,51 ml. Similar changes were traced in the MVBS index it diminishes on 7,7±0,23% (p<0,05). Compared to a standing position before physical loading, FCR after a 10 min. limbering-up increases to 96,1±0,29%; APs – to 45,9%, while APd, conversely, decreases to 6,74% (p<0,05). Herewith CO increases in 1,5 times, MVC – in 2,92 times (p<0,05). From data of separate authors [7, 10], physical loading at FCR 140–160 shots in a minute is characterized as aerobic. For growth of training effect during this loading duration of implementation of exercises must be not less than 5 min., as a result the positive changes take place in lipoprotein composition of blood, however do not appear in the MCO and of level of threshold of anaerobic exchange (LTAE) indexes [6].

In a basic part of exercise in a period from 10 to 35 min. FCR increases to 20,9% (table 1). Herewith APs increases to 9,25% , while APd diminishes on 7,51% (p<0,05).

Comparatively with the previous loading SV increased on 17,5±1,14%, and MVBS on 43,6±0,86%. Consequently, the work on this segment of the exercise was mainly executed in the aerobic-anaerobic mode. Literary information testify that such training conditions above all things are accompanied by the increase of maximal consumption of oxygen (MCO) and increase of level of threshold of anaerobic exchange (LTAE) [7].

In a basic part of exercise during 35–50 min. FCR makes 24,1% less than in a previous part of exercise and accords the aerobic character of loadings [3].

Indexes of AP were near to the indexes of the previous part of employment and made 165,5±2,44 / 68,7±2,39 mm. merc. col., namely APs decreased on 9,4±0,81%, and APd increased on 12,8±0,62% comparatively with the previous part of the exercise.

In the final part of exercise the FCR decrease to 61,9 shots in a minute was fixed right away during the implementation of the first pose and with small oscillation (±2,65 shots in a minute) herewith, its indexes were kept at implementation of complex exercises. AP re-commences to the initial values, it's indexes make 114,7±1,66/59,6±1,67 mm. merc. col., it. SV decreased comparatively with the previous part of the exercise on 20,2±0,75% and made 76,7±2,11 ml, that on 1,9±0,2% less from an initial level in the same position of body. MVBS decreased on 4,4 times comparatively with the second part and on 2,8 – with the third.

Comparatively with the initial level the MVBS index was higher only on 0,50±0,3%, so the difference between indexes is not reliable (P>0,05).

Consequently, all gotten indexes of hemodynamic testify that static work in combination with respiratory exercises conduce the renewal of the CVS functions.

In 2 minutes after the end of the exercise all indexes of hemodynamics attained an initial level. Difference between them before the beginning of the exercise and after 2 min. of renewal is not reliable (p>0,05). Rapid renewal of all indexes of hemodynamics after the exercise can be explained that these processes began already from the fourth part of the exercise, that is approximately before 20–30 min. to it's ending.

The insignificant increase of cardiac rhythm in the fifth part is linked not so much with implementation of exercises, which took place in a slow rate and, mainly, was directed on development of flexibility, how many with the change of position of body.

The analysis of dynamics of indexes of cardioregulation (tabl.2) setted, that in a state of rest the maximal value of cardiocycles (MxRR) were consorted with the area of the normergics adjusting, and minimum (MnRR) to the – adrenalergics area, that testifies the increase of sympatetic influence on the vegetative contour of adjusting of the CSV activity. However the swing variability (ΔRR) for all youngsters was high – 0,29±0,05 sec., which is consorted with the reference rate [4].

Table 2

The indexes of cardioregulation in rest and during the whole exercise (M±m, n=35)

Part of the exercise	MxRR	MnRR	ΔRR	MO	AMO, %	IPRS
Before the exercise (standing)	0,87± 0,09	0,61± 0,04	0,29± 0,05	0,77± 0,03	25,8± 3,55	53,4± 8,44
0–10 min.	0,62± 0,03	0,56± 0,04	0,09± 0,02	0,55± 0,02	39,4± 1,25	432,8± 45,22
10–30 min	0,60± 0,02	0,48± 0,02	0,25± 0,01	0,59± 0,03	42,5± 0,89	266,4± 27,63
30–50 min.	0,56± 0,03	0,51± 0,02	0,12± 0,01	0,45± 0,03	88,5± 1,95	791,1± 71,83
50–60 min.	0,88± 0,02	0,63± 0,03	0,35± 0,01	0,69± 0,02	76,5± 1,83	174,3± 19,87
In 2 min. after the exercise	0,99± 0,05	0,55± 0,08	0,49± 0,03	0,75± 0,03	27,80± 4,60	46,3± 7,12

The Mo value makes 0,77±0,03 c and is consorted with the average value of cardiocycles. AMo is evened 25,8±3,52%, and IPRS – 53,4±8,43, that is consorted with the normotonics type of cardioregulation.

After the limbering-up the MxRR and MnRR decreased considerably, and ΔRR was 0,09±0,02 c, that testifies the advantage of the adrenal influencing on "pasmacer". The Mo value was 0,59±0,02 c, that on 29,9% less, than before the exercise, and testifies the decrease of activity of humoral channel of adjusting of rhythm of heart. AMo, that characterizes likable influences on cardioregulation, is increased to 34,5±2,03%. In 8,1 times is multiplied IPRS, that, from data of O.P Alferov and co.[2], M.Y. Vanyushyn [6] and B.M. Myckan and co. [8] characterizes the inworking CVS processes during a limbering-up.

Compared with the indexes before the beginning of exercise in a basic part (10–30 min.) there is a decrease of MxRR to 45,0±1,21%, and MnRR – to 27,1±0,92%, that shows the increase of adrenergic influence on vegetative outline of cardiac activity. However the swing variability increases in 8,0 times, which is 0,16±0,01 c. The insignificant growth of Mo (only

on 7,3±0,27%) can not characterize activation of the humoral adjusting [1,2,5]. More reliable there is the increase of ($p<0,01$) the AMo indexes average on 62,4±2,33%, that is also the sign of subsequent increase of the adrenergic influences. Compared with the previous part of the exercise there is a considerable IPRS decrease (on the average on 62,4±2,26% – до 266,42±27,63).

Consequently, the gotten indexes can testify the stabilization of cardioregulation after a limbering-up and during implementation of the exercises in aerobic and aerobic-anaerobic modes in vertical position of body.

In the period from 30 to 50 min. in the basic part of the exercise the MxRR uncertainly decreases (to 29,5±2,03%), and MnRR increases (to 6,2±0,08%) , due to what the swing of variation becomes less in 2,1 times ($p<0,05$). Comparatively with the first half of the basic part of the exercise AMo increases in 2,0 times ($p<0,05$) . All it characterizes subsequent growth of the adrenergic influences on the cardioregulation. The activity of humoral channel of rhythm of heart remained at the previous level. Considerably the IPRS index changed ($p<0,01$) it was multiplied to 3,0 times that testifies the growth of excitation of the system of circulation of blood. Obviously, such features of cardioregulation are related to muscular work in horizontal position of body, when due to the positive inotropic influences on a heart, the force and speed of reduction of myocardium is multiplied. From data of M.Y. Vanyushyn [5], for youths in whose IPRS makes a 100–900 y.o, appropriately develops moderate stress, which is not a result of the substantial changes of homeostasis.

During the pause of relaxation (50–60 min.), the dynamics of all indexes testifies the subsequent restoration processes in the system of cardio regulation.

More reliable ($p<0,05$) the MxRR and MnRR indexes increased (to 42,9±2,63% і 23,5±1,31%). Herewith the swing of variation increased in 2,9 times and was on 20,6±1,82% bigger from the output level, that testifies the activation of parasympathetic part of the vegetative adjusting of cardiac rhythm. The Mo indexes make 0,69±0,02, that increases on 46,6±2,02% comparatively with the previous part of the exercise but it does not achieve basic data and characterizes activation of humoral channel of adjusting of cardiointervals.

The AMo value decreases on 12,9±0,83% comparatively with information in the previous part of exercise, however it was higher from the output data, that is possible to describe as a tendency to weakening of the adrenergic influences. After the pause of relaxation the IPRS (to 174,3±19,87) diminished considerably, that is in 4,5 times less, than after implementation of the dynamic physical loading without using of respiratory exercises ($p<0,01$).

In 2 min. after the end of the exercise the humoral influences stays on the previous level, and the nerve regulation of rhythm of heart significantly changes. Comparatively with the data of the previous part of the exercise a slight increase of MxRR (to 12,5±0,73%) and decrease of MnRR (to 12,5±0,73%) leads to a reliable increase of the swing of variation ($p<0,05$).Herewith the AMo index increases to 8,6±0,32% and are almost equal to output data. Considerably decreases AMo and IPRS in 2,7 and 3,8 times accordingly ($p<0,05$).Their indexes almost equal to output, that shows the holinergic channel of influence on "paisemaker" prevails in this part.

The analysis of gotten results (table 2) gave a chance to determine the influence of different kinds of physical loadings on the type of cardio regulation. Based on M.Y. Vanyushyn [6] and V. L. Karpman [7] the period of work is characterized by a considerable strengthening of adrenergic influence [6], which is seen by the decrease of MxRR, MnRR, ΔRR and Mo during the increase of AMo and IPRS.

A slight strengthening of adrenergic influences and decrease of IPRS during the implementation of the exercises in aerobic and aerobic-anaerobic modes in vertical position of body indicate the adaptation of organism to a physical loading [3,9]. Changing the position of body to horizontal during the aerobic loadings conduces the considerable increase of

adrenergic influences on cardio regulation. The ΔRR index decrease, the AMo and IPRS considerably increase.

On a high and submaximal level of power of physical work (the basic part of exercise) the changes in humoral channel of the regulation of rhythm of heart were not fixed. The Mo significantly ($p<0,05$) decreases during the limbering-up and does not change during the whole period of specific loadings.

Along with this, in a process of implementation of breathing exercises there is a reliable ($p<0,05$) increase of Mo, which indicate the activity of humoral channel of regulation of rhythm of heart. Besides, the tendence of strengthening of cholinergic influences was fixed. The ΔRR indexes increase and the AMo and IPRS decrease.

Obligate for relaxation is a considerable increase of cholinergic influences on "pais-maker". The ΔRR and Mo indexes considerably increase and the AMo and IPRS decrease.

Consequently, from the beginning of the 30-th min. of the exercuse, the cardio regulation is gradually recovering, due to activation of humoral channel of regulation during the breathing exercises and relaxation, and the whole recover at the end of the exercise with the strengthening of parasympathetic regulation of cardiovascular activity occurs.

Conclusions

1. The analysis of hemodynamic indexes during the whole exercise shows that the training influence on cardiovascular system have dynamic physical exercises of the basic part of exercise, which are done in aerobic and aerobic-anaerobic regimes, and respiratory exercises accelerate reduction processes, which is a reliable physiological basis to increase the health-training effect from physical exercises combined with relaxation.

2. The changes of power of work, muscles contraction character and position of body during the implementation of the exercises create conditions to improve the adaptive-compensatory reactions of organism on different types of loadings.

The prospects of further investigations are in studying the influence of breathing exercises on increase of functional reserves of organism of people of different age and sex.

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PROFESSIONAL PORTRAIT OF FUTURE INSTRUCTORS IN PHYSICAL TRAINING OF PRESCHOOLERS

Мета: виявити ступінь готовності студентів до ведення валеологічної діяльності у дошкільних закладах освіти. Завданням дослідження було виявити взаємозв’язок між виховно-оздоровчою освітою і готовністю студентів до валеологічної діяльності. Методи: в дослідженні приймали участь 550 студентів (n=550). Результати: Анкетування дозволило встановити педагогічні умови, які характеризують систему підготовки студентів, що передбачає ведення валеологічної діяльності для формування власної валеологічної культури дітей. Показано, що формування у студентів валеологічної культури є визначальною умовою ефективного функціонування такої системи в дошкільних закладах освіти. При цьому підготовка студентів факультету фізичного виховання і спорту до валеологічної діяльності знаходиться на низькому рівні. Висновки: Дослідження теоретичних основ професійної підготовки майбутніх інструкторів з фізичного виховання дошкільників до ведення валеологічної діяльності показали, що тільки 11,7% опитаних студентів мають відповідну підготовку і володіють необхідними знаннями і практичними навиками.

Ключові слова: *фізичне виховання, валеологічна культура, інструктор з фізичного виховання.*

Цель: выявить степень готовности студентов к ведению валеологической деятельности в дошкольных образовательных заведениях. Задачей исследования было выявить взаимозависимость между уровнем воспитательно-оздоровительного образования и готовностью студентов к валеологической деятельности. Методы: в исследовании принимали участие 550 студентов (n=550). Результаты: Анкетирование разрешило установить педагогические предпосылки, которые характеризуют систему подготовки студентов, что предполагает ведение валеологической деятельности для формирования собственной валеологической культуры детей. Показано, что формируемая у студентов валеологическая культура является определяющим условием эффективного функционирования такой системы в дошкольных общеобразовательных заведениях. При этом подготовка студентов факультета физического воспитания и спорта к валеологической деятельности находится на низком уровне. Выводы: Исследования показали, что только 11,7% опрошенных студентов имеют соответствующую подготовку и владеют необходимыми знаниями и практическими навыками.