12. Zaychik A. Sh. Osnovy obshey patologii. Ch 2. Osnovy patokhimii. /A.Sh. Zaychik, L.P. Churilov. – SPb.: ELBI, 1999 – 688 s.

13. Sokolovskiy V.V. Gistokhimicheskie issledovaniya v toksikologii / Sokolovskiy V.V. – L.: Meditsina, 1971. – 176 s.

14. Kheykhou F. Gematologicheskaya tsitokhimiya / F. Kheykhou, D. Kvaglino – M.: Meditsina, 1983. – 319 s.

УДК 796.015.1:537.3-056.2

THE COMPLEX ANALYSIS OF PULSE LOW-FREQUENCY ELECTRIC CURRENT INFLUENCE ON ORGANISM FUNCTIONAL CONDITION IN TRAINED AND UNTRAINED YOUNG PEOPLE IN CONDITIONS OF PHYSICAL REST

Kovalyova A.V., Shkopinskii E.A., *Kivenko V.V., Dyomin A.N.

Zaporozhian national university

69600, Ukraine, Zaporozhye, Zhukovskogo street, 66

** Zaporozhian state clinical hospital №8*

69000, Ukraine, Zaporozhye, Pischevaya street, 2

kovaleva_aleksan@mail.ru

The short characteristic of functional condition of trained and untrained young men in conditions of physical rest is given in the paper following the analysis of unitary pulse low-frequency electric current influence on the specified processes. The aim of the study was to compare the characteristics of a pulse low-frequency electric current influence on cardiovascular system functional condition in trained and untrained persons in conditions of physical rest. The study included 56 healthy young men (23 trained and 33 untrained) 17-24 years old, who were divided into the main group (11 trained and 16 untrained persons) and control group (12 trained and 17 untrained persons) and 46 healthy young women (28 trained and 18 untrained) 17-20 years old, who were divided into the main group (14 trained and 9 untrained persons) and control group (14 trained and 9 untrained persons). The study included two stages: the first stage – the baseline functional condition was estimated; the second stage – the functional condition state reaction to pulse low-frequency electric current in conditions of physical rest was recorded. The pulse low-frequency electric current influence was produced using the device "LEIT". The results suggest that the pulse low-frequency electric current carries out regulating influence on physiological systems of young people even in conditions of physical rest and has the character of cardiovascular system activity optimization and vegetative functions optimization.

Key words: pulse low-frequency electric current, functional condition, trained young men, untrained young men, trained young women, untrained young women, physical rest

КОМПЛЕКСНИЙ АНАЛІЗ ВПЛИВУ ІМПУЛЬСНОГО НИЗЬКОЧАСТОТНОГО ЕЛЕКТРИЧНОГО СТРУМУ НА ФУНКЦІОНАЛЬНИЙ СТАН ОРГАНІЗМУ ТРЕНОВАНИХ І НЕТРЕНОВАНИХ МОЛОДИХ ОСІБ У СТАНІ ФІЗИЧНОГО СПОКОЮ

Ковальова О.В., Шкопинський Є.О., *Ківенко В.В., Дьомін О.М.

Запорізький національний університет

69600, Україна, Запоріжжя, вул. Жуковського, 66

**Запорізька міська клінічна лікарня №8*

69000, Україна, Запоріжжя, вул. Харчова, 2

kovaleva_aleksan@mail.ru

У роботі надана стисла характеристика функціонального стану тренованих і нетренованих осіб в умовах фізичного спокою з впливом імпульсного низькочастотного електричного струму. Метою дослідження було порівняти особливості впливу імпульсного низькочастотного електричного струму на функціональний стан серцево-судинної системи тренованих і нетренованих осіб в умовах фізичного спокою. Дослідження включало 56 здорових молодих осіб (23 треновані і 33 нетреновані)

17-24 років, які були розподілені на основну групу (11 тренованих і 16 нетренованих осіб) і контрольну групу (12 тренованих і 17 нетренованих осіб) і 46 здорових молодих жінок (28 тренованих і 18 нетренованих осіб) 17-20 років, які були розподілені на основну групу (14 тренованих і 9 нетренованих осіб) і контрольну групу (14 тренованих і 9 нетренованих осіб). Дослідження включало дві етапи: на першому етапі досліджувався вихідний функціональний стан, на другому – реакція функціонального стану на імпульсний низькочастотний електричний струм в умовах фізичного спокою була зареєстрована. Вплив імпульсного низькочастотного електричного струму проводився з використанням приладу "LEIT". Результати передбачають, що імпульсний низькочастотний електричний струм здійснює регуляторний вплив на фізіологічні системи молодих осіб навіть в умовах фізичного спокою і має характер оптимізації діяльності серцево-судинної системи і вегетативних функцій.

Ключові слова: імпульсний низькочастотний електричний струм, функціональний стан, треновані юнаки, нетреновані юнаки, треновані дівчата, нетреновані дівчата, фізичний спокій

КОМПЛЕКСНЫЙ АНАЛИЗ ВЛИЯНИЯ ИМПУЛЬСНОГО НИЗКОЧАСТОТНОГО ЭЛЕКТРИЧЕСКОГО ТОКА НА ФУНКЦИОНАЛЬНОЕ СОСТОЯНИЕ ОРГАНИЗМА ТРЕНИРОВАННЫХ И НЕТРЕНИРОВАННЫХ МОЛОДЫХ ЛИЦ В СОСТОЯНИИ ФИЗИЧЕСКОГО ПОКОЯ

Ковалева А.В., Шкопинский Е.А., *Кивенко В.В., Демин А.Н.

Запорожский национальный университет

69600, Украина, Запорожье, ул. Жуковского, 66

**Запорожская городская клиническая больница №8*

69000, Украина, Запорожье, ул. Пищевая, 2

kovaleva_aleksan@mail.ru

В роботе дана краткая характеристика функционального состояния тренированных и нетренированных лиц в условиях физического покоя с влиянием импульсного низкочастотного электрического тока. Целью исследования было сравнить особенности влияния импульсного низкочастотного электрического тока на функциональное состояние сердечно-сосудистой системы тренированных и нетренированных лиц в условиях физического покоя. Исследование включало 56 здоровых юношей (23 тренированных и 33 нетренированных) 17-24 лет, которые были поделены на основную группу (11 тренированных и 16 нетренированных лиц) и контрольную группу (12 тренированных и 17 нетренированных лиц) и 46 здоровых девушек (28 тренированных и 18 нетренированных лиц) 17-20 лет, которые были поделены на основную группу (14 тренированных и 9 нетренированных лиц) и контрольную группу (14 тренированных и 9 нетренированных лиц). Исследование включало два этапа: на первом этапе исследовалось исходное функциональное состояние, на втором – реакция функционального состояния на импульсный низкочастотный электрический ток в условиях физического покоя была зарегистрирована. Влияние импульсного низкочастотного электрического тока проводилось с использованием прибора "LEIT". Результаты предполагают, что импульсный низкочастотный электрический ток осуществляет регуляторное влияние на физиологические системы молодых лиц даже в условиях физического покоя и имеет характер оптимизации деятельности сердечно-сосудистой системы и вегетативных функций.

Ключевые слова: импульсный низкочастотный электрический ток, функциональное состояние, тренированные юноши, нетренированные юноши, тренированные девушки, нетренированные девушки, физический покой

INTRODUCTION

The need for studying physiological mechanisms which underlie changes of human functional condition under the pulse low-frequency electric current (PLFEC) influence, estimation of optimality of such changes and their specific orientation have been considered in a considerable number of studies [1-3]. Some studies attempted to study physiological mechanisms which define positive reactions of cardiovascular system, locomotor apparatus, external respiration system and other physiological characteristics of an organism to this exposure [4, 5]. The cumulated data enable their application in clinical practice and achieving positive medical effect [6-12].

However, studies of organism functional condition changes following exposure to PLFEC are extremely insufficient. There are few data [4, 5], which were received in different conditions and on different tool base and which are not systematized. Absence of the unified approach to estimation of functional condition measurements in methodical and methodological maintenance of such studies

restricts possibilities of the analysis and practical use of the practically obtained results. It particularly concerns the area of functional condition in conditions of physical rest.

The aim of the study was to study the pulse low-frequency electric current influence at functional condition in conditions of physical rest in trained and untrained persons (17-24 years old).

MATERIALS AND METHODS

102 healthy young people (17-24 years old) participated in research. The groups of trained young men and women were presented by qualified sportsmen (51 persons – 33 young men and 18 young women). Examined people have been divided into 4 groups: the first group (the main) – 25 persons (11 trained men and 14 trained women); the second group (the main) – 25 persons (16 untrained men and 9 untrained women); the third group (the control) – 26 persons (12 trained men and 14 trained women); the fourth group (the control) – 26 persons (17 untrained men and 9 untrained women).

The study included two stages: the first stage – the baseline functional condition was estimated; the second stage – the functional condition state reaction to pulse low-frequency electric current in conditions of physical rest was recorded. Indices of central blood circulation were defined by rheographic method. The following measurements were taken: systolic arterial pressure (SAP, mm Hg), diastolic arterial pressure (DAP, mm Hg), heart rate (HR, bpm), systolic blood volume (SBV, ml), minute blood volume (MBV, ml/min), cardiac index (CI, l/min m^2), general peripheric vascular resistance (GPVR, din·s·cm^{-1}). Diagnostics of heart rate variability included research of stress index (SI, s.u.), vegetative balance index (VBI, s.u.), index of centralization (IC, s.u.) [13]. The obtained results were processed statistically. Exposure to PLFEC was carried out by means of LEIT device according to a standard technique [14].

RESULTS AND DISCUSSION

The researches spent before the beginning of experiment, confirm, that all registered cardiovascular indices at young men and women were in borders of age and physiological norm [15, 16] (tab. 1). So, rest HR values at untrained young men and women were in normocardia borders at insignificant sympathoadrenal activity at young women. SAP values also corresponded to standard sizes. Lower SAP levels at untrained women in comparison with young men testify to the known hypotonic syndrome connected with features of hormonal profile [17, 18]. DAP level was below the sizes usually accepted for norm.

Table 1. Functional state of circulatory system and neurohumoral mechanisms condition at young men and women, ($\overline{M}$ ± m)

Groups / Indices	Untrained		Trained	
	Young men (n=33)	Young women (n=18)	Young men (n=23)	Young women (n=28)
HR, bpm	79,42±0,88	81,33±0,70	62,26±0,88***	63,25±0,69***
SAP, mm Hg	117,88±1,66	107,50±2,66***	118,26±1,59	108,93±2,09***
DAP, mm Hg	70,61±0,99	69,44±1,71**	71,30±1,30	66,43±1,43*** ***
SBV, ml	70,89±1,88	68,84±3,98	76,91±5,24	70,57±3,63
MBV, ml/min	5636,91±167,49	5586,70±315,12	4783,31±331,08*	4448,68±221,08**
CI, l/min·m^2	2,90±0,07	3,25±0,18*	2,48±0,18	2,66±0,12**
GPVR, din·s·cm^{-5}	1130,45±37,87	1119,99±55,35	1607,52±122,99***	1372,56±68,33*
SI, s.u.	149,33±4,83	167,29±7,16*	117,04±4,88***	129,39±6,13***
VBI, s.u.	23,96±1,23	24,67±1,03	22,68±1,04	24,47±1,07
IC, s.u.	1,87±0,06	2,10±0,06*	0,58±0,04***	2,01±0,04***

Note here and futher: * (at p ≤ 0,05), ** (at p ≤ 0,01), *** (at p ≤ 0,001) – significant difference between young men and women; * (at p ≤ 0,05), ** (at p ≤ 0,01), *** (at p ≤ 0,001) – significant difference between trained and untrained persons

SBV and MBV at untrained young men and women completely correspond to indices, which are characteristic for untrained persons [19, 20]. At the same time indexed blood circulation indices, in particular CI, testify to the best haemodynamic maintenance of a female organism, including the lower GPRV (tab. 1).

Arterial pressure and MBV lower sizes and HR higher sizes of chronotropic heart function at young women can be the basis for the assumption of more significant, if necessary, increases of system arterial pressure and blood flow volume indices in them at smaller mobility on HR increase.

System haemodynamics indices at trained persons also lay within measures of cardiovascular system standard regulation (tab. 1) [21, 22]. HR in groups of trained young men and women is in normocardia limits, coming nearer to the bottom border of norm, at some leveling, in comparison with untrained, sexual differences on this index. SAP and DAP sizes do not fall outside the norm limits, displaying described above sexual differences in SAP regulation.

System haemodynamics volume indices, such as SBV and MBV, also correspond to norm borders, at little bit lowered MBV sizes which come nearer to the bottom border of norm, both at young men and women. At trained persons CI testifies to the best haemodynamic security of an organism at young women, at lower GPRV sizes.

Thus, character of differences of system blood circulation basic indices at trained young men and women repeats the character of gender distinctions at untrained persons, except practically absence of divergences on HR (tab. 1).

Data comparison on system haemodynamics indices which were registered at trained and untrained persons, displays, in general, known data about optimization of cardiovascular system functional condition under the influence of physical activities [23-27].

Chronotropic heart indices in rest show heart function relative identity of HR index at young men and women (tab. 1). However available authentic differences between the trained and untrained young men and women can be characterized as approach to a sports bradycardia which is expressed in authentically HR low size at trained young men and women in comparison with untrained (tab. 1).

System arterial pressure indices in rest at comparison of trained and untrained persons show SAP and DAP lower level at trained persons in comparison with untrained persons. In the absence of authentic differences this tendency is outlined accurately enough, except for DAP which at the trained young women was authentic lower.

The data cited above correspond to representations about lower level of functional pressure in rest at trained persons [28, 29].

The highest SBV index is registered at trained young men (tab. 1), the lowest – at untrained young women. Trained young women and untrained young men SBV occupy intermediate position and authentically do not differ.

GPVR was at trained young men and women authentically above than at untrained while CI sizes were authentically lower at trained young women in comparison with untrained, that can be explained by different degree of physical activity of surveyed groups.

Considering necessity of an estimation not only cardial, but also a vegetative component of regulation, and possible differences between the trained and untrained persons on level of general activity and sympathoadrenal system functional changes, and also parasympathetic nervous system, the estimation of these parametres on the basis of variation pulsometria indices was represented necessary.

The obtained data analysis has shown, that cardiovascular system SI of untrained young men and women is in limits of standard characteristics [30]. A little higher authentic SI level at untrained young women, probably, displays higher psychoemotional reaction to inspection. Thus VBI to sexual signs authentically does not differ and displays parasympathetic components prevalence in this surveyed group, that, probably, can be explained by high academic loads (tab. 1). The analysis of IC indices testifies to standard sizes at untrained young men and about insignificant prevalence of parasympathetic influence at young women.

Values of vegetative indices at trained persons testify that cardiovascular system SI was in norm limits on absolute sizes at trained young men, displaying already described sexual differences (tab. 1). VBI indices authentically do not differ, while IC at trained young men authentically lower, than at trained young women, which can testify about defined (in particular biorhythmologycal) humoral factor influence (tab. 1).

At the same time the comparative analysis of functional indices and regulatory mechanisms of trained and untrained young men and women allows to draw following conclusions. So, SI (tab. 1) was authentic lower at trained young men and women in comparison with untrained. SI size at untrained persons answers the top border of norm while at trained persons it is approached to the bottom border of norm that can be regarded as display of certain functional changes connected with optimization of nervous system as a result of physical activities.

VBI indices at trained persons authentically do not differ from these indices at untrained, that entirely adequately describes the general firmness of vegetative nervous system and can testify to higher optimization of nervous system at trained persons.

IC at trained young men authentically lower, than at untrained young men that can testify to cardial component prevalence in system haemodynamics regulation. At the same time such differences at trained and untrained young women are not registered, that can testify about defined (in particular biorhythmologycal) humoral factor influence.

The received results characterize the general functional condition of healthy people organism of young age which are engaged or do not go in for sports, and on all indices are in limits of age and physiological norm. Indices of functional condition of trained persons show changes which arise at active sports activity.

Unitary PFLEC influence on all surveyed was spent in a condition of clinostatic rest. The carried out research has allowed to estimate degree of cardiovascular system and vegetative nervous system functional changes in reply to stimulation according to a standard technique [14].

Obtained data comparison in condition of rest (tab. 1) and after unitary PFLEC influence allow to conclude (tab. 2), that unitary PFLEC stimulation does not cause the expressed changes of physiological systems, and furthermore the effects connected with infringements of a psychosomatic condition of an organism.

So, HR level at untrained young men authentically did not differ from indices at untrained young women after unitary PFLEC influence (tab. 2). However, in comparison with background sizes (tab. 1), the tendency to HR decrease is observed and at untrained young men, and at untrained young women. Such, doubtfully expressed tendency on HR decrease after unitary influence can be carried not only to direct action PFLEC, but also to psychoemotional organism adaptive reaction on costume factors. At the same time at trained young men and women such unequivocal tendency was not observed. It can be connected as with initial HR lower sizes at trained persons at whom further decrease borders are sufficiently limited, and with higher psychoemotional adaptability of trained persons to various inspections and another costume factors (tab. 2).

Table 2. PFLEC influence on functional state of circulatory system and neurohumoral mechanisms condition at young men and women, ($\overline{M}$ ± m)

Groups / Indices	Untrained		Trained	
	Young men (n=16)	Young women (n=9)	Young men (n=11)	Young women (n=14)
HR, bpm	76,82±0,84	79,44±1,14	61,35±1,20***	64,04±0,78***
SAP, mm Hg	113,33±0,96	103,61±1,27***	118,48±1,35**	106,61±0,68*** *
DAP, mm Hg	71,06±1,06	68,89±0,50	67,39±1,33*	62,68±0,70** ***
SBV, ml	67,27±1,70	65,60±4,01	79,27±5,15	74,93±4,17
MBV, ml/min	5178,57±153,36	5199,38±317,04	4843,73±318,74	4791,44±271,69
CI, l/min·m^2	2,67±0,07	3,03±0,18*	2,51±0,18	2,87±0,16
GPVR, din·s·cm^{-5}	1353,96±44,86	1315,88±77,58	1549,49±110,14	1390,58±69,16
SI, s.u.	131,07±4,44	151,87±7,45**	110,28±5,07***	120,24±6,38***
VBI, s.u.	20,53±0,71	22,86±0,99*	21,68±1,04	22,42±1,09
IC, s.u.	1,66±0,04	1,88±0,05**	0,54±0,03***	1,95±0,04***

Unitary influence PFLEC on all surveyed was spent in a clinostatic rest condition. The carried out research has allowed to estimate degree of cardiovascular system and vegetative nervous system functional changes in reply to stimulation according to a standard technique [14].

At comparison of the received data in a condition of rest (tab. 1) and after unitary influence PFLEC can be concluded (tab. 2), that unitary stimulation PFLEC does not cause the expressed changes of physiological systems, and furthermore the effects connected with infringements of a psychosomatic condition of an organism.

So, HR level at untrained young men authentically did not differ from indices at untrained young women after unitary PFLEC influence (tab. 2). However, in comparison with background sizes (tab. 1), is observed the tendency to HR decrease and at untrained young men, and at untrained young women. Such, doubtfully expressed, the tendency on HR decrease after unitary influence can be carried not only to direct PFLEC action, but also to psychoemotional organism adaptive reaction on custom factors. At the same time at trained young men and women such unequivocal tendency was not observed. It can be connected as with lower sizes HR initial at trained persons at whom borders of further decrease are sufficiently limited, and with higher psychoemotional adaptability of the trained persons to various inspections and another custom factors (tab. 2).

SAP indices were authentically lower at untrained young women in comparison with untrained young men. The same tendency is observed and in groups of trained persons. The comparative analysis of SAP sizes at untrained and trained young men, as well as at trained and untrained young women testifies about authentic lowest sizes at untrained persons in comparison with the trained. Also it has been noticed, that SAP, displaying cardiovascular system vegetative regulation psychoemotional component, after PFLEC processing tended to decrease at untrained young men and women in comparison with condition of rest which can testify to the general decrease in degree of uneasiness during research, than about direct reaction to influence (tab. 2). At the same time, at trained young men and women SAP size before and after influence were practically identical, most likely, thanks to the best adaptation of trained persons to similar inspections (tab. 2).

At comparison of untrained and trained young women authentically lower sizes of DAP at trained young women was observed. Authentically lower DAP indices are observed in groups of untrained young men and women in comparison with untrained. However it has been noticed, that level of DAP at untrained young men and women before and after PFLEC influence did not change. While at trained persons DAP size after influence was doubtfully below initial both at young men, and at young women. Considering that DAP testifies to bigger measure of arterial vessels elasticity and to lesser degree of dependence on psychoemotional factor, it is possible to draw a conclusion that at the heart of such though and not entirely authentic decrease, there can be other mechanisms of

regulation of system arterial pressure which probably change the parametres under the PFLEC influence processing.

Considering dependence between decrease in DAP level and change of system blood circulation volume indices (SBV and MBV) can be assumed, that level of circulating blood volume does not change under PFLEC influence. SBV sizes at untrained young men and women before and after PFLEC influence slightly and doubtfully decreased. The same tendency was observed and on SBV. Such doubtful and insignificant decrease in both groups practically was not displayed at system arterial pressure level and also, probably, testifies to decrease in level of a psychoemotional pressure and cardiovascular system functional condition optimization.

At the same time SBV dynamics at trained young men and women before and after unitary PFLEC influence testifies to blood percussive emission increase after unitary PFLEC influence, that, probably, is caused by PFLEC influence on inotropic heart function. MBV increase which is registered at trained young men and women before and after unitary PFLEC influence against HR sizes which do not change, in addition testifies to PFLEC influence on cardial component of cardiovascular system work regulation.

Against insignificant SAP decrease and not changed DAP doubtful decrease in volume indices leads to insignificant and doubtful GPVR increase at untrained young women before and after unitary PFLEC influence. At the same time authentic GPVR increase at untrained young men before and after unitary PFLEC influence was observed, that against initial enough GPVR low sizes can testify about defined constricting orientation of unitary PFLEC influence.

DAP level decrease after unitary influence at trained persons against increase in system blood flow volume indices finds the display in GPVR decrease after unitary PFLEC influence both at trained young men, and at trained young women.

At regulatory organism mechanisms analysis marked authentically higher SI sizes at untrained young women in comparison with untrained young men. Also observed authentically higher SI sizes at trained young men and women. However, despite the revealed authentic differences between investigated groups, all surveyed SI sizes were in normotonia limits. Research of vegetative nervous system regulatory mechanisms changes level against unitary PFLEC influence shows, that cardiovascular system SI at untrained young men and women has decreased in comparison with baseline indices (tab. 1). Changes were doubtful, and SI indices remained within age and physiological norm. At trained young men and women the tendency to SI decrease was observed at comparison of sizes before and after unitary PFLEC influence.

On VBI indices authentic differences have been noted only between untrained young men and women, and the comparative analysis of VBI sizes changes before and after unitary PFLEC influence had the same tendency, as SI. IC sizes were authentically higher at young women, both trained, and untrained, in comparison with young men. The comparative analysis of IC indices testified about authentic lower sizes at trained young men in comparison with untrained. In the same time observed, that IC sizes at untrained young men decreased. At untrained young women the same tendency was observed. VBI at trained young men and women before and after unitary PFLEC influence practically remained invariable, that is possible to tell and about IC (tab. 2).

Thus, it is possible to conclude, that all above-stated indices were in norm limits, and their sizes testify to some decrease in sympathetic influence which proves to be true also by obtained in cardiovascular system research data.

The obtained data allow to assume, that unitary PFLEC influence on healthy people organism in a rest condition carries out insignificant correcting influence which is in limits of doubtful changes. At the same time the certain tendency to change of some indices owing to doubtful on absolute value, but enough unidirectional decrease in sympathetic activity has been revealed. In particular decrease in HR level at untrained persons and some SAP decrease was observed, that, probably, testifies to PFLEC influence on vegetative nervous system sympathetic department. However, HR

indices which remained invariable, some DAP decrease at the expense of increase in volume blood flow indices can testify that PFLEC influence carries out certain positive stimulating influence on inotropic heart function.

At an estimation of vegetative balance the obtained data confirm a conclusion about decrease in sympathetic activity at untrained persons and about absence of changes of this index at trained persons.

Thus, irrespective of physical characteristics of applied influence on an organism, even after unitary PFLEC application the tendency concerning to putting in order of heart activity which is displayed in inotropic heart functions increase and vascular tone decrease is observed at different stages, but unidirectional at the trained and untrained persons. The obtained data can be caused also by optimization of vegetative reactions which minor alteration is observed at an estimation by a variation pulsometria method.

The perspectives of further researches are to study the PFLEC influence on persons of another age and another degree of training and reaction of their heart activity and vegetative nervous system on this influence. Also can be studied reaction of another systems and organs on PFLEC influence at trained and untrained young persons.

CONCLUSIONS

1. The received results characterize the general functional condition of healthy people organism of young age which are engaged or do not go in for sports, and on all indices are in limits of age and physiological norm. Indices of functional condition of trained persons show changes which arise at active sports activity.
2. Obtained data comparison in condition of rest and after unitary PFLEC influence can be concluded that unitary PFLEC stimulation does not cause the expressed changes of physiological systems, and furthermore the effects connected with infringements of a psychosomatic condition of an organism.
4. Thus, it is possible to conclude, that all above-stated indices were in norm limits, and their sizes testify to some decrease in sympathetic influence which proves to be true also by obtained in cardiovascular system research data.

LITERATURE

1. Боголюбов В.М. Общая физиотерапия / В.М. Боголюбов, Г.Н. Пономаренко. – М., СПб.: Медицина, 2003. – 480 с.
2. Краткий справочник физиотерапевта: Методические рекомендации / Л.Т. Гильмутдинова, С. А. Вечерова. – Уфа: ДизайнПолиграф-Сервис, 2007. – 40 с.
3. Пономаренко Г.Н. Биофизические основы физиотерапии: учебное пособие / Г.Н.Пономаренко, И.И. Турковский. – М.: Медицина, 2006. – 176 с.
5. Попадюха Ю.А. Применение нетрадиционных средств в профилактике остеохондроза у спортсменов силовых видов спорта / Ю.А. Попадюха, С.А. Сычев // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2007. – №4. – С. 170-174.
6. Высоцкая Е.Ф. Скэнар-реабилитация при вертеброгенном болевом синдроме / Е.Ф. Высоцкая, Н.В. Степанова // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2007. – №4. – С. 35-36.
7. Лечение гипертонических кризов с цефалгической формой / [Ковалева О.В., Фуштей И.М., Поталов С.А. и др.] // Сборник статей Харьковской городской клинической больницы скорой неотложной помощи «Неотложная медицинская помощь» / Харьків: ХМАПО, 2005. – С. 176-183.

8. Опыт лечения кардиалгий, не связанных с патологией сердца на догоспитальном этапе / [Ковалева О.В., Поталов С.А., Голдовский Б.М. и др.] // Проблемні питання медицини невідкладних станів: Матеріали симпозіуму (V школа-семінар), Київ, 5-6 квітня 2007 р. – Київ, 2007 – С. 75-76.

9. Особенности изменения вегетативного гомеостаза при лечении артериальной гипертензии / [Ковалева О.В., Фуштей И.М., Селивоненко В.Г. и др.] // Від фундаментальних досліджень – до прогресу в медицині: Матеріали науково-практичної конференції з міжнародною участю, присвяченої 200 –річчю з дня заснування Харківського державного медичного університету, Харків, 17-18 січня 2005р. – Харьків, ХДМУ, 2005. – С. 120-121.

10. Адаптація осіб молодого віку при зміні кліматичних умов / [Токаренко О.І., Маликов Н.В., Ковель Н.М. та інш.] // Український Бальнеологічний науково-практичний журнал. – 2006. – № 1-2. – С. 52-56.

11. Вариабельность сердечного ритма у больных с патологией желудочно-кишечного тракта / А.И. Токаренко, И.М. Фуштей, Л.В. Порада // Лекарства – человеку. Современные проблемы создания, исследования и апробации лекарственных средств: материалы научно-практической конференции с международным участием, (Харьков, 23 марта 2006 г.). – Харьков, 2006. – С. 234-239.

12. Зміни серцевого ритму у хворих з патологією жовчо-вивідної системи / [Токаренко О.І., Ковальова О.В., Ковбель Н.М. та інш.] // Український Бальнеологічний науково-практичний журнал. – 2006. – № 1-2. – С. 56-60.

13. Особенности изменения вегетативного гомеостаза при лечении артериальной гипертензии / [Фуштей И.М., Ковалева О.В., Селивоненко В.Г. и др.] // Від фундаментальних досліджень – до прогресу в медицині: матеріали науково-практичної конференції з міжнародною участю, присвяченої 200 –річчю з дня заснування Харківського державного медичного університету (Харків, 17-18 січня 2005 р.) – Харків, ХДМУ, 2005. – С. 120-121.

14. Баевский Р.М. Анализ вариабельности сердечного ритма при использовании различных электрокардиографических систем / Р.М. Баевский, Г.Г. Иванов, Л.В. Чирейкин [и др.] // Вестник аритмологии. – 2001. – №24. – С. 65-86.

15. Ковалева О.В. Аппарат волновой энергоинформационной терапии LEIT®. MODEL No. АТ-30897 / О.В. Ковалева, А.В. Ковалева, С.Н. Проценко [и др.] – Запорожье. Днепропетровск, 2011. – 61 с.

16. Богдановська Н.В. Величини деяких функціональних показників у хлопців та дівчат у віці 17-ті років // В зб.: Актуальні проблеми фізичної культури та спорту в соціально-економічних умовах. – Запоріжжя, 2005. – С. 160-168.

17. Косинський Е.О. Стан серцево-судинної системи студентів першого року навчання / Е.О. Косинський, Ю.М. Андрійчук, В.М. Ходінов // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2010. – №5. – С. 79-81.

18. Сердюк І.В. Результати вивчення показників артеріального тиску у студенток / І.В. Сердюк // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2012. – №1. – С. 105-108.

19. Шахлина Л.Я. Медико-биологические основы спортивной тренировки женщин / Л.Я. Шахлина. – К.: Наукова думка, 2001. – 326 с.

20. Крапівіна К. Стан гемодинаміки у жінок репродуктивного віку під впливом аеробних та аеробно-анаеробних навантажень / К. Крапівіна, В. Цимбал, Н. Лисак [і інш.] // Теорія і практика фізичного виховання і спорту. – 2002. – №2-3. – С. 62-63.

21. Patrick B.T. Influence of weight training status on hemodynamic adjustments to isometric actions / B.T. Patrick, A. Caterisano // J Sports Med Phys Fitness. – 2002 – №42(4). – P. 451-7.

22. Мельников А.А. Особенности гемодинамики и реологических свойств крови у спортсменов с разной направленностью тренировочного процесса / А.А. Мельников, А.Д. Викулов // Теория и практика физической культуры. – 2003. – №1. – С. 23-26.

23. Степук О.В. Функціональні особливості гемодинамічних параметрів серцево-судинної системи під впливом факторів різної природи: автореф. дис. на здобуття наук. ступеня канд. біол. наук: спец. 03.00.13 «Фізіологія людини і тварин» / О.В. Степук. – Львів., 2003. – 23 с.

24. Взаємозв'язок між фізичною підготовленістю і функціональним станом серцево-судинної системи [Електрон. ресурс] / Д.С. Присяжнюк, А.І. Драчук, Л.Ю. Дудорова // Педагогіка, психологія та мед.-біол. пробл. фіз. виховання і спорту. — Х., 2002. – №20. – С. 41-45.

25. Корінчак Л.М. Вплив фізичного навантаження на показники серцево-судинної системи студентів / Л.М. Корінчак // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2008. – №7. – С. 74-76.

26. Решетняк О.А. Особенности адаптации сердечно-сосудистой системы на физическую нагрузку у студентов различного уровня тренированности / О.А. Решетняк// Ученые записки Таврического национального университета им. В.И.Вернадского. Серия «Биология». – 2005. – Том 18 (57), №3. – С. 140-143.

27. Manolas V.M. Echocardiographic changes in the development of the athlete’s heart in 9 to 20-year-old male subjects / V.M. Manolas, G. Pavlik, A. Banhegyi et al // Acta Physiol Hung. – 2001. – №88(3-4). – P. 259-70.

28. Palazzetti S. Overloaded training increases exercise-induced oxidative stress and damage / S. Palazzetti, M.J. Richard, A. Favier et al // Can J Appl Physiol. – 2003. – №28. – P. 588-604.

29. Иоффе Л.А. Сердечная деятельность у спортсменов в условиях покоя / Л.А. Иоффе, Г.М. Куколевский // Сердце и спорт. – М, 1968. – С. 6-37.

30. Каніщева О.П. Моніторинг стану здоров’я студентів з різним рівнем фізичної підготовленості / О.П. Каніщева // Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту. – 2009. – №12. – С. 73-76.

31. Богатов А.А. Связь индекса напряженности регуляторных систем и других показателей сердечного ритма со специальной работоспособностью лыжников-гонщиков / А.А. Богатов // Теория и практика физической культуры. – 2003. – №1. – С. 54-55.

REFERENCES

1. Bogolyubov V.M. Obschaya fizioterapiya / V.M. Bogolyubov, G.N. Ponomarenko. – M., SPb.: Meditsina, 2003. – 480 s.

2. Kratkiy spravochnik fizioterapevta: Metodicheskiy rekomendatcii / L.T. Gilmutdinova, S.A. Vecherova. – Ufa: DizaynPoligraf-Servis, 2007. – 40 s.

3. Ponomarenko G.N. Biofizicheskiye osnovy fizioterapii: uchebnoe posobiye / G.N.Ponomarenko, I.I. Turkovskiy. – M.: Meditsina, 2006. – 176 s.

4. Popadyuha Y.A. Primeneniye netradicionnykh sredstv v profilaktike osteohondroza u sportsmenov silovyh vidov sporta / Y.A. Popadyuha, S.A. Sychev // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2007. – №4. – S. 170-174.

5. Vysotskaya E.F. Skenar-reabilitatsiya pri vertebrogennom bolevom sindrome / E.F. Vysotskaya, N.V. Stepanova // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2007. – №4. – S. 35-36.

6. Lechenie gipertonicheskih krizov s tsefalgicheskoy formoy / [Kovaleva O.V., Fushtey I.M., Potalov S.A. i dr.] // Sbornik statey Kharkovskoy gorodskoy klinicheskoi bolnitsy skoroy neotlozhnoy pomoschi «Neotlozhnaya medicinskaya pomoshch» / Harkiv: HMAPO, 2005. – S. 176-183.

7. Opyt lecheniya kardialdiy, ne svyazannih s patologiey serdtsa na dogospitalnom etape / [Kovaleva O.V., Potalov S.A., Goldovskiy B.M. i dr.] // Problemni pitannya meditsiny nevidkladnih staniv: Materialy simpoziumu (V shkola-seminar), Kyiv, 5-6 kvithya 2007 r. – Kyiv, 2007 – S. 75-76.

8. Osobennosti izmeneniya vegetativnogo gomeostaza pri lechenii arterialnoy gipertenzii / [Kovaleva O.V., Fushtey I.M., Selivonenko V.G. i dr.] // Vid fundamentalnyh doslidzhen – do progresu v medytsini: Materialy naukovo-praktychnoy konferenciyi z mizhnarodnoyu uchastu, prasvyachenoyi 200–richchyu z dnya zasnuvannya Kharkivskogo derzhavnogo medychnogo universytetu, Kharkiv, 17-18 sichnya 2005 r. – Kharkiv, HDMU, 2005. – S. 120-121.

9. Adaptatsiya osib molodogo viku pry zmini klimatychnyh umov / [Tokarenko O.I., Malikov N.V., Kovel N.M. ta inch.] // Ukrainskiy balneologichniy naukovo-praktichniy zhurnal. – 2006. – № 1-2. – S. 52-56.

10. Variabelnost serdechnogo ritma u bolnih s patologiey zheludochno-kischechnogo trakta / A.I. Tokarenko, I.M. Fushtey, L.V. Porada // Lekarstva – cheloveku. Sovremenniye problemy sozdaniya, issledovaniya i approbatsii lekarstvennyh sredstv: materialy nauchno-practicheskoy konferentsii s mezhdunarodnym uchastiem, (Kharkov, 23 marta 2006 g.). – Kharkov, 2006. – S. 234-239.

11. Zmini sercevogo ritmu u hvorih z patologieyu zhovchno-vyvydnoyi sistemy / [Tokarenko O.I., Kovalyova O.V., Kovbel N.M. ta insch.] // Ukrainskiy balneologichniy naukovo-praktichniy zhurnal. – 2006. – № 1-2. – S. 56-60.

12. Osobennosti izmeneniya vegetativnogo gomeostaza pri lechenii arterialnoy gipertenzii / [Fushtey I.M., Kovaleva O.V., Selivonenko V.G. i dr.] // Vid fundamentalnyh doslidzhen – do progresu v medytsini: materialy naukovo-praktichnoy konferentsii z mezhdunarodnoyu uchastyu, prusvyachenoy 200–richchyu z dnya zasnuvannya Kharkivskogo derzhavnogo medychnogo universytetu, Kharkiv, 17-18 sichnya 2005 r. – Kharkiv, HDMU, 2005. – S. 120-121.

13. Baevskiy R.M. Analiz variabelnosti serdechnogo ritma pri ispolzovanii razlicnyh elektrokardiograficheskih sistem / R.M. Baevskiy, G.G. Ivanov, L.V. Chireykin [i dr.] // Vestnik aritmologii. – 2001. – №24. – S. 65-86.

14. Kovaleva O.V. Apparat vonovoy energoinformatsionnoy terapii LEIT®. MODEL No. AT-30897 / O.V. Kovaleva, A.V. Kovaleva, S.N. Protsenko [i dr.] – Zaporozhye. Dnepropetrovsk, 2011. – 61 s.

15. Bogdanovkaya N.V. Velychiny deyakhih funktsionalnih pokaznykiv u hloptsiv ta divchat u vitsi 17-ti rokiv // V zb.: Aktualni problemy fisychnoy kulturi ta sportu v sotsialno-ekonomichnyh umovah. – Zaporizhzhya, 2005. – S. 160-168.

16. Kosynskiy E.O. Stan sertsevo-sudynnoy csystemy studentiv perschogo roku navchannya / E.O. Kosynskiy, Y.M. Andriychuk, V.M. Hodinov // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2010. – №5. – S. 79-81.

17. Serdyuk I.V. Resultaty vyvchennya pokaznykiv arterialnogo tysku u studentok / I.V. Serdyuk // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2012. – №1. – S. 105-108.

18. Shahlina L.Y. Medyko-biologicheskiye osnovy sportivnoy trenirovki zhenschin / L.Y. Shahlina. – K.: Naukova dumka, 2001. – 326 s.

19. Krapivina K. Stan gemodynamiki u zhinok reproduktivnogo viku pid vplyvom aerobnyh ta aerobno-anaerobnyh navantazhen / K. Krapivina, V. Tsimbal, N. Lysak [i inch.] // Teoriya i praktyka fisychnogo vyhovannya i sportu. – 2002. – №2-3. – S. 62-63.

20. Patrick B.T. Influence of weight training status on hemodynamic adjustments to isometric actions / B.T. Patrick, A. Caterisano // J Sports Med Phys Fitness. – 2002 – №42(4). – P. 451-7.

21. Melnikov A.A. Osobennosti gemodinamiki I reologicheskih svoystv krovi u sportsmenov s raznoy napravlennostyu trenirovochnogo protsesa / A.A. Melnikov, A.D. Vikulov // Teoriya i praktika fizicheskoy kultury. – 2003. – №1. – S. 23-26.

22. Stepuk O.V. Funktsionalni osoblyvosti gemodynamichnih parametriv sertsevo-sudynnoy systemi pid vplyvom faktoriv riznoy prirody: avtoref. dys. na zdobuttya nauk. stupenya kand. biol. nauk: spets. 03.00.13 «Fiziologiya lyudyny I tvaryn» / O.V. Stepuk. – Lviv, 2003. – 23 s.

23. Vzaemozvyazok mizh fizychnoyu pidgotovlenictyu I funktsionalnym stanom sertsevo-sudynnoy systemy [Elektron. resurs] / D.S. Prisyazhnyuk, A.I. Drachuk, L.Y. Dudorova // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. — Kh., 2002. – №20. – S. 41-45.

24. Korinchak L.M. Vplyv fizychnogo navantazhennya na pokaznyki sertsevo-sudynnoy systemy studentivв / L.M. Korinchak // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2008. – №7. – C. 74-76.

25. Reshetnyak O.A. Osobennosti adaptatsii serdechno-sosudistoy na fizicheskuyu nagruzku u studentov razlichnogo urovnya trenirovannosti / O.A. Reshetnyak // Uchenye zapiski Tavricheskogo natsionalnogo universiteta im. V.I.Vernadskogo. Seriya «Biologiya». – 2005. – Tom 18 (57), №3. – S. 140-143.

26. Manolas V.M. Echocardiographic changes in the development of the athlete's heart in 9 to 20-year-old male subjects / V.M. Manolas, G. Pavlik, A. Banhegyi et al // Acta Physiol Hung. – 2001. – №88(3-4). – P. 259-70.

27. Palazzetti S. Overloaded training increases exercise-induced oxidative stress and damage / S. Palazzetti, M.J. Richard, A. Favier et al // Can J Appl Physiol. – 2003. – №28. – P. 588-604.

28. Ioffe L.A. Serdechnaya deyatelnost u sportsmenov v usloviyah pokoya / L.A. Ioffe, G.M. Kukolevskiy // Serdtse I sport. – M, 1968. – S. 6-37.

29. Kanischeva O.P. Monitoring stanu zdorovya studentiv z riznym rivnem fizychnoy pidgotovlenosti / O.P. Kanischeva // Pedagogika, psihologiya ta mediko-biologochni problemy fizychnogo vyhovannya i sportu. – 2009. – №12. – S. 73-76.

30. Bogatov A.A. Svyaz indeksa napryazhennosti regulyatornyh system I drugih pokazateley serdechnogo ritma so spetsialnoy rabotosposobnostyu lyzhnikov-gonschikov / A.A. Bogatov // Teoriya i praktyka fisycheskoy kultury. – 2003. – №1. – C. 54-55.

УДК 599.323.41:591.619

ЗМІНА СИЛИ СКОРОЧЕННЯ ІШЕМІЇЗОВАНОГО M. GASTROCNEMIUS (CAP. MED.) У АЛКОГОЛІЗОВАНИХ ЩУРІВ ПІД ЧАС ПРОГРЕСИВНОЇ НИЗЬКОЧАСТОТНОЇ М'ЯЗОВОЇ ВТОМИ

Коцан І. Я., Мельничук О. А., Мотузюк О. П.

Східноєвропейський національний університет імені Лесі Українки,

43025, Україна, Луцьк, просп. Волі, 13

olexiymelnychuk@gmail.com

Досліджено силову продуктивність ішеміїзованого m. gastrocnemius (cap. med.) у алкоголізованих щурів під час прогресивної низькочастотної м'язової втоми. Хронічна алкогольна інтоксикація здійснювалась шляхом ентерогастрального введення етилового спирту досліджуваним щурам (n=3) протягом 30 днів. Для індукції васкулярної ішемії, тривалістю 3 години, досліджуваним щурам (n=6) лігували *a. femoralis.* Тензометричні дослідження динаміки тетанічного скорочення ішеміїзованого m. gastrocnemius (cap. med.) в алкоголізованих щурів досліджувались в ізометричному режимі, за умов безпосередньої електричної стимуляції. Результати дослідження свідчать про зменшення силової продуктивності ішеміїзованого *m. gastrocnemius (cap. med.)* в алкоголізованих щурів, порівняно з неалкоголізованими.

Ключові слова: алкоголізація, васкулярна ішемія, тетанічна сила, м'язова втома, m. gastrocnemius.

ИЗМЕНЕНИЕ СИЛЫ СОКРАЩЕНИЯ ИШЕМИИЗИРОВАННОГО M. GASTROCNEMIUS (CAP. MED.) У АЛКОГОЛИЗИРОВАННЫХ КРЫС ВО ВРЕМЯ ПРОГРЕССИВНОЙ НИЗКОЧАСТОТНОЙ МУСКУЛЬНОЙ УСТАЛОСТИ

Коцан И. Я., Мельничук А. А., Мотузюк А. П.

Восточноевропейский национальный университет имени Леси Украинки,

43025, Украина, Луцк, просп. Свободы 13

olexiymelnychuk@gmail.com

Исследована силовая производительность ишемиизированного *m. gastrocnemius* (cap. med.) у алкоголизированных крыс во время прогрессивной низкочастотной мускульной усталости. Хроническая алкогольная интоксикация осуществлялась путем энтерогастрального введения этилового спирта исследуемым крысам (n=3) в течение 30 дней. Для индукции васкулярной ишемии,