

JUSTIFICATION FOR EXPERIMENTAL METHODS FOR CIRCUIT TRAINING AEROBICS CLASSES FIRST MATURE AGE WOMEN

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Annotation. *Purpose:* develop and validate a methodology for circuit training aerobics. Methodology focused on improving physical health first mature age women. *Material:* a study was conducted with 81 women (age 21 - 35 years). *Results:* justified the means and methods of circuit training, the duration of the structural components, the rational parameters of physical activity, pulse modes. Depending on the physical health of women developed a set of circuit training for the main part of the session. Complex circuit training consists of 2 series, active rest interval between 3 minutes. Duration of employment in one series of 23 minutes. Exercises are performed at 5 locations: 3 - aerobic (3x5 min), 2 - power (2x4 min). The total duration of training - 49 minutes. The intensity of the training load is regulated by the level of physical health and the maximum test results. *Conclusions:* The positive changes morphofunctional indicators show an increase in the body's bioenergy and women transition to a higher level of physical health.

Keywords: women, health, aerobics, method, training.

Introduction

Preservation of health as important part of human capital is one of factors, basing on which they determine compatibility of state at international level. On all stages of human development there must be realized three groups of opportunities: long and healthy life span, acquirement of knowledge and access to resources for maintaining of healthy life style [31].

Motion functioning is an integral component of healthy life style. It is well known [27] that existing close connection between motion functioning and high level of health witnesses that immobile life style facilitates worsening of health of most of people. Only regular and systemic motion functioning in human life style ensures significant rising health level.

It was noted [29] that among different kinds of motion functioning especially expressive is field of health related physical culture, which includes not only the process of health improvement owing to systemic targeted trainings but also solution of closely connected with them problems: eating, psychic regulation, formation individual life style, cultivation of active social position and so on.

One of main tasks for scientists and practitioners, who work in field of health related physical culture is correct selection of means and methods of motion skills' training, owing to which morphological functional condition and physical fitness of trainees would improve [35].

Successful solution of this task is possible in the process of circuit health related physical culture trainings. L.P. Matveyev noted [14, pg. 378] that "detail development of "circuit training" method resulted in spreading of a number of its variants, designed for training of general endurance, connected with complex manifestation of different motion skills (including power and speed) in frames of combined motion functioning".

Results of numerous researches prove effectiveness of circuit training; point at popularity of its usage in practically all forms of physical culture, on all stages of human ontogeny [30, 32-36].

Against the background of various information about different variants of aerobics, main part of which contains alternating of aerobic and power exercises in definite periods of time, there are practically no scientifically grounded recommendations for effective application of circuit training at aerobic trainings. Till present time problems of selection of means and methods, duration of structural components, rational parameters of physical loads and pulse modes according to physical condition of trainees have not been solved completely [13].

The above rendered material determines urgency of development and scientific foundation of circuit training method at training of first mature women, considering their physical health level (LPH).

The researches have been fulfilled in compliance with combined plan of scientific & research work in sphere of physical culture and sports for 2006-2010 of Ministry of youth and sports of Ukraine in the frames of topic 3.1.5 "Theoretical-methodic and applied principles of physical education in higher educational establishments of Ukraine", state registration number 01006U011725.

Purpose, tasks of the work, material and methods

The purpose of the research is to develop and scientifically ground methodic of circuit training at aerobic trainings, oriented on rising of LPH of first maturity women. The researches were carried out on base of physical education department of State higher educational establishment "National mine university" (Dniepropetrovsk) and covered 81 women of 21-35 years old age.

The tasks of the research: to develop methodic of circuit training for aerobic trainings of first maturity women and to determine its effectiveness, basing on dynamic of physical health indicators.

The methods of the research: analysis and generalization of scientific-methodic literature; pedagogic experiment; methods of express evaluation of LPH [8]; methods of mathematical statistics.

Results of the researches

Specificity of tasks, organizational forms, means and methods of physical education of different population strata is conditioned both by age peculiarities and by social factors [<http://www.vospityvatm.ru> – Education of children/physical education of adults.].

Every age period is characterized by certain changes in organism. Age of first maturity is characterized by the highest indicators of physical workability and fitness, by optimal adaptation to unfavorable environmental factors, by less indicators of morbidity [10]. For women this stage is in the range of from 21 to 35 years.

Mature women play important role in modern society, fulfilling a lot of socially significant functions (industrial, social, political, family, reproductive, educational and other). With it one of decisive condition of effectiveness of these functions' realization is high general workability, basing on sound somatic and mental health of women [6, 20].

In this connection physical education process for mature persons shall solve the most important tasks – strengthening and preservation of health, maintaining of optimal vital activity and high workability.

Among different kinds of motion functioning health related physical culture is especially distinguished with its main target – increasing of organism's functional state and rising of physical workability [29].

With planning and organization of health related training of women the authors [26] specify the following principles:

- Orientation of health related training on development of general endurance (owing to ensuring of aerobic energy supply processes);
- Limitation of speed power exercises in health related training, that is conditioned by less capacity of anaerobic energy supply mechanisms;
- Practicing of power exercises for correction of body mass, considering state of pelvis floor (possible prolapse of pelvic floor with increasing of intra-abdominal pressure).

Basing on results of own resulting experiment [13] and following the above rendered principles the authors oriented experimental methodic of circuit training at trainings of first mature women on increasing of trainees' physical condition and realization of the following tasks:

1. Facilitating of body composition owing to reduction of fat percentage in body.
2. Facilitating of cardio-vascular and respiratory systems' condition.
3. Improvement of physical workability.
4. Increasing of strength, improvement of backbone flexibility and mobility.

Physical endurance is rather important for optimization of human life functioning and health; it permits to fulfill significant motion activity for long period of time and keep high level of its intensity; it permits to restore forces after significant loads [9]. The most important kinds of endurance are general endurance and power endurance [28].

For example, general endurance is closely connected with development and functioning of cardio-vascular and respiratory systems and, therefore, with aerobic potentials of organism [26], because most of motion functions in domestic and working conditions go, mainly in aerobic mode [28].

Basic abilities, which determine the level of power endurance, are power, capacity and saving potential of energy supply systems [17], as well as inter-muscular and intra-muscular coordination, ability to concentrate muscular forces. In this connection methodic of its development is based, mainly, on laws of development of general endurance [9].

It was noted [14] that in practice of physical education the most often are training with complex content and that is why they include a number of different kinds of motion functioning.

The most frequent kind of general endurance's training is circuit training ("circuit" is absolutely conventional name), facilitating complex influence of its main factors.

Training means are physical exercises and complexes of them, which are characterized by the following features:

- Active functioning of most or all large links of supporting motor system;
- Mainly aerobic energy supply of muscular work;
- Comparatively significant total duration of work (from several minutes to several dozens of minutes);
- Moderate, high and alternate intensity (consequently analogous power) of work.

These distinctive features belong to movements of health related aerobics, which involve large muscles of lower limbs in work (quadriceps of thigh, gluteus, most adductors, poluchila muscle, paliperidonese muscle and biceps), influencing positively on cardio-vascular and respiratory systems of organism [4, 12]. Aerobic is a system of physical exercises, energy supply of which is ensured by consuming of oxygen [Kravitz L. Aerobics vs. Resistance Training Is This the Battle of the Fitness Titans [Electronic resource] / Kravits L. –Access: <http://www.drlenkravitz.com/Articles/aerobicresistanc.html>].

Optimal structural components of health related aerobic trainings, as well as any other organized form of physical training, are three parts: warming up, main and final [3]. With it, structure, content and duration both of separate parts and the training in the whole can be of different variants depending on tasks, targets and kind of aerobic, while type of training influences greatly [4].

The structure of aerobic complex training, oriented on development of strength and endurance, changes, but with preservation of its main parts.

Warming up part does not depend critically on how many tasks shall be solved within one training. But in main part of complex aerobic training there shall be marked out two main components, following, as a rule, in sequence: aerobic training – the power one.

However, it was noted [11] that specialists were arguing which order of main part was the most effective: “aerobic part → power part” or “power part → aerobic part”.

“Distribution of power exercises is determined to large extent by wish to fulfill the most valuable attempts against the background of optimal, “fresh” state of central nervous system. With it creation and perfection of nervous-coordination relations are the most effective that ensures increment of muscular strength. If power exercises were fulfilled when a sportsmen was tired after previous work, nervous system’s excitability will be reduced and conditional-reflexive functioning will be less successful, increment of strength will be slowed. Power exercises are the most effective, if they are practiced at the beginning of main part of training” [5, pg.62].

We offer to combine power and aerobic exercises in first half of main part, i.e. apply circuit training, oriented on complex training of general and power endurance in dozed periods of time.

Owing to combination of aerobic and power loads in the first half of main part, in the second half exercises are fulfilled only in parterre (on mat) and quantity of time for final stretching increases.

Also it should be noted that there are variants of circuit training, in which there are strictly oriented physical exercises, combined in one motion functioning and conjugated with significant total scope of loads. It permits to effectively influence on main factors of general endurance of complex character. In the same way flow-type (without pauses or with pauses of active rest) complexes of gymnastic aerobic exercises or aqua-aerobic exercises are fulfilled [14].

Therefore, circuit aerobic training is an organizational-methodic form of training with structural components of - alternating aerobic and power fragments.

Analysis of scientific-methodic literature [30] shows that information about structure, content and duration of aerobic and power components is not complete.

As a result of generalization of above presented material we worked out complex of circuit training (see table 1), which shall be realized in main part of aerobic training.

Table 1

Methodic characteristic of worked out complex of circuit aerobic training of first mature women

Circuit training as durable continuous exercise			
Structural components	Aerobic “station”		Power “station”
Means	Aerobic exercises		Static-dynamic exercises
Main training influence	Cardio-vascular and respiratory systems		Muscular system
Intensity of physical load	40-50% MOC	Low LPH	25-40% MTL
	45-50% MOC	LPH below middle	
	50-60% MOC	Middle LPH	40-50% MTL
	60-75% MOC	High and above high LPH	50-60% MTL
Quantity of “stations” in one circle	5		
	3	2	
Duration of work in one “station”	5 min	4 min	
Quantity of circles	2		
Duration of one circle	23 min		
Rest between circles	3 min		

Notes: % MTL training load, measured in percents from maximal result; %MOC – maximal oxygen consumption.

Circuit training at aerobic trainings is characterized by fulfillment of work as durable continuous exercise – with relatively constant intensity, moderate and high power, in “flow” manner, repeatedly and without strictly determined rest pauses after changing of kind of functioning. As far as pauses are short load can be regarded as continuous.

In the process of working out of circuit training complex and for grounded choice of physical load’s intensity we based on the following:

- Physiological responses of organism and their after effects, which can appear in the course of training – orthostatic effect (collapse) and pressure effect [23];
- Physiological characteristics of aerobic exercises [22] and pulse modes of training of cardio-vascular system [<http://www.zdorove.ru> –medical site about health.];
- Gradation of physical exercises depending on volume of muscular groups, participating in work [9, 24, 28, 29];
- Dozing of intensity, scope and multiplicity of health related training, considering LPH [2, 26];
- Optimal level of intensity for stimulation of cardio-vascular and respiratory systems, created for persons with low LPH at loads with intensity of 40-50% MOC, with LPH below middle – 45-50% MOC, middle LPH - 50-60% MOC, with high and above high LPH – 60-75% MOC [10].

Aerobic “station” of circuit aerobic training is fulfillment of exactly aerobic exercises, in which not less than 2/3 of muscular mass of body participate. Time of fulfillment of exercises at every aerobic “station” of circuit training is 5 minutes. According to chronology of energetic spectrum in the process of cardio-vascular and respiratory systems’ development fulfillment of physical exercises from 3 minutes to several hours corresponds to state of even oxygen consumption [18].

Power “station” of circuit aerobic training is fulfillment of complex of static-dynamic exercises oriented on development and improvement of power endurance.

Methodic of power “stations” is based on some principles of power exercises’ application with health related purpose [21]:

- The lower is initial fitness of trainees the less quantity of muscles shall be involved in every exercise;
- Muscles tensions shall be within 30-60% from maximal arbitrary force. Mode of work shall be static-dynamic, i.e. without relaxation of muscles during all attempt. It shall be achieved owing to slow speed of exercises’ fulfillment, amplitude and constant tension of muscles;
- Exercises shall be fulfilled in not maximal muscles efforts’ manner – by multiple overcoming of not maximal external resistance up to significant tiredness;
- Exercises shall be fulfilled in non-stop manner, i.e. without rest pauses. In case of “flow” method pause between exercises shall be filled with stretching.
- In most cases it is recommended to combine exercises in “super series”, which shall be used in two variants: 1) alternating of two-three attempts for two muscular groups; 2) changing initial position or exercise itself, repeated loading of the same muscular groups.

Training load is expressed in percents from maximal result (%MTL) [16]: 25-40 %MTL for persons with low and below level LPH, 40-50% MTL – with middle LPH and 50-60% MTL for persons with high and above high LPH. Load is in range of moderate and high power and is mainly of aerobic or combined aerobic-anaerobic character.

Time for exercises of power “station” is about 4 minutes. The data witness [18] that for power exercises of moderate intensity (3-4 points by Berg’s scale) with duration of more than 3 minutes energetic substrate are: fats, muscular glycogen and glucose of blood. That is the existing oxidizing processes, in the base of which there is organism’s ability to absorb and utilize oxygen, point at aerobic mechanism of energy generation for durable work.

The worked out complex of circuit aerobic training consists of 2 “circles” with active rest interval between them of 3 minutes [28]. It was noted [17] that compensator work is very important as rehabilitation mean, videlicet: exercises of not high intensity (substantially lower than threshold of anaerobic metabolism, 30-50% MOC). Duration of one “circle” is 23 minutes (fulfillment of exercises in 5 “stations”): 3 aerobic “stations” (3x5 min.) and 2 power “stations” (2x4 min.). Total duration of complex is 49 minutes.

From above said it is followed that circuit training with justified duration of its structural components and intensity of training loads adequate to level of physical health, adaptation potentials of trainees, can render positive influence on level of physical health of first maturity women.

For determination of effectiveness of the worked out methodic we carried out comparative analysis of indicators of morphological functional indices of physical health express-evaluation [8] of experimental group (EG) and control group (CG) women before and after experiment (see table 2).

In the process of analysis of the received results we registered substantial changes in mean statistic values of morphological functional indices: mass-height index reduced by 4.63% ($\alpha_I \leq 0.05$), power index increased 16.00% ($\alpha_I \leq 0.001$), index “double product” reduced by 14.86% ($\alpha_I \leq 0.001$), index PWC_{170} increased by 15.54% ($\alpha_I \leq 0.001$) and Rufiet’s index decreased by 43.59% ($\alpha_I \leq 0.001$).

Table 2

Indicators of physical health of EG and CG women before and after pedagogic experiment

Group	Statistic characteristics of EG (n=36) and CG (n=45)						
	Before experiment $\bar{x} \pm \sigma$	After experiment ($\bar{x} \pm \sigma$)	t_1	α_1	Difference%	t_2	α_2
Mass/height index, g/cm							
EG	350.02±37.28	333.80±30.65	2.02	≤0.05	4.63	0.05	≥0.05
CG	345.83±39.31	334.13±35.11	1.49	≥0.05	3.38		
Power index, %							
EG	77.11±11.14	82.49±11.28	4.31	≤0,01	16.00	2.28	≤0.01
CG	72.35±10.60	76.81±10.98	1.96	≥0.05	6,6		
Double product, conv.un.							
EG	89.45±17.16	76.16±9.84	4.03	≤0.001	14.86	4.14	≤0.001
CG	94.74±16.54	85.02±9.29	3.64	≤0.001	10.62		
PWC ₁₇₀ , W/kg							
EG	2.51±0.36	2.90±0.32	4.88	≤0.001	15.54	1.54	≥0.05
CG	2.58±0.39	2.78±0.39	2.45	≤0.01	7,5		
Rufiet's index, conv.un.							
EG	13.58±5.16	7.66±2.98	5.96	≤0.001	43.59	2.60	≤0.01
CG	13.41±4.23	9.55±3.56	4.68	≤0.001	28.78		
Level of physical health, points							
EG	11.94±3.67	16.72±3.00	6.05	≤0.001	40.03	3.39	≤0.01
CG	11.29±4.30	14.27±3.51	3.60	≤0.001	26.40		

In control group positive changes were registered in reduction of mass-height index by 3.38% ($\alpha_2 \geq 0.05$), “double product” index – by 10.62% ($\alpha_1 \leq 0.01$) and Rufiet's index – by 28.78% ($\alpha_1 \leq 0.001$) as well as in increment of power index by 6.16% ($\alpha_1 \geq 0.05$) and PWC₁₇₀ index – by 7.75% ($\alpha_1 \leq 0.01$).

The registered positive changes of morphological-functional indicators after pedagogic experiment witness firmly about increasing of organism's bio-energetic resources and, thus, about transition of first mature women to higher level of physical health (see table 3).

Table 3

Distribution of women by level of physical health before and after pedagogic experiment (%)

Group		Level of physical health				
		High	Above high	Middle	Below middle	Low
EG (n=36)	Before	2.78	19.44	58.33	13.89	5.56
	after	33.33	50.00	13.89	2.78	-
CG (n=45)	Before	4.44	20.00	33.33	35.56	6.67
	after	15.56	33.33	37.78	13.33	-

In the process of comparative analysis of express-evaluation's results we determined great number of EG persons - 83,33% (n=30), who were at “safe” level of health (before experiment – 22.22% (n=8)), were “endogeneous risk factors, manifested forms of chronic not-catching diseases practically were not registered as well as risk of death because of them” [1, pg.38].

Quantity of women with low LPH decreased from 58.33% (n=21) to 13.89% (n=5) and with level below middle – from 13.89% (n=5) to 2.78% (n=1). Persons with low LPH were not registered at the end of pedagogic experiment (up to – 5.56% (n=2)).

On the base of mean mark of physical health level we can conclude that EG members increased LPH as a result of pedagogic experiment.

It means that the purpose of our research has been achieved: the worked out methodic of circuit aerobic training facilitates increasing of first maturity women's physical health.

Conclusions:

1. The fulfilled researches resulted in foundation of means and methods of circuit aerobic training of first maturity women, duration of its structural components, rational parameters of physical loads and pulse modes according to physical health level of trainees.

2. Circuit aerobic training is characterized by fulfillment of work as a continuous durable exercise with relatively constant intensity, moderate and high power, in "flow" manner, repeatedly and without strictly determined rest pauses between different kinds of motion functioning. Intensity of training load for circuit training's components was determined by level of physical health and results of maximal test.

3. Results of pedagogic experiment revealed positive influence of worked out by us methodic of circuit aerobic training of first maturity women, considering their physical health level and differentiation of loads. It permits to recommend it for implementation in practice of health related physical culture. Effectiveness of experimental methodic is proved by increasing of physical health level of trainees.

The prospects of further researches are studying of effectiveness of circuit training's application at aerobic trainings for second maturity women.

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