

## ORIGINAL ARTICLE

## COMPLEX ESTIMATION OF FITNESS TRAINING SYSTEMS AND WOMEN'S SOMATIC HEALTH OF THE FIRST PERIOD MATURE AGE

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### ABSTRACT

**The aim:** To model, to ground and to check experimentally the efficiency of the complex organized system of fitness trainings and system of health improving trainings; to discover their influence on the status of women's somatic health of the first period mature age.

**Materials and methods:** Analysis, systematization, pedagogical observation, modelling, pedagogical experiment, tests: Ruffier, Stange, Romberg's, Harvard step test and tests of PWC170.

**Results:** Complex organized system of fitness trainings (dosed, systematic, complex motive activity, managed by trainer) appeared more effective (11.68 %) in comparison with system of individual health improving trainings (6.54 %). Both systems contributed to reducing of weight (CG2 – 3.8 %, EG2 – 16.3 %), decrease in body's parts sizes, in particular, of breast (CG2 – 0.5 %, EG2 – 1.3 %), waist (CG2 – 2.3 %; EG2 – 13.75 %), pelvis (CG2 – 3.6 %; EG2 – 5.3 %), formation of physical characteristics (strength – CG2 – 2.1 %, EG2 – 17.4 % and flexibility – CG2 – 4.5 % and EG2 – 9 %). Differences in the level of physical capacity are marked, mainly, in the control group (PWC170absolute – 12.2 %; PWC170relative – 19.3 %), in comparison with experimental (PWC170 absolute – 10.2 %; PWC170 relative – 17.5 %).

**Conclusions:** In general both systems assisted the improvement of somatic health level that proves the efficiency of system approach to organization of trainings in this age-related group.

**KEY WORDS:** somatic health, fitness trainings, health improving trainings, women of the first period mature age

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### INTRODUCTION

Health promotion in conditions of modern society development, with its peculiar features of socio-economic, scientific and technological progress, changes in values and motivational attitudes, is the problem of primary importance. The importance of maintaining and improving human health is determined by legal normative documents, which emphasize that the highest social value in a country is a person, his/her life and health. At the same time, it is important to note that for each person there is an optimal range of physical activity, necessary for the normal body's development and functioning, preservation of health. Fitness activities completely provide the body's need for movement activity, they are safe because they are based on the natural locomotions of person. Fitness programs are multi component technologies. Physical component is based on determining the level of physical development, physical qualities, functional status of the human body's systems; the main factor which influences the status of health is the right orientation of physical activity, in particular: its intensity, duration, number of exercises. Psychical component is determined by personal capabilities, individual characteristics of psyche; the basic factor is aspiring to perfection and development. Socio-economic component determines the level of consciousness

to systematic trainings, motivation, necessities, interests, financial possibility; the basic factor is the requirement in notional social equality, public recognition, realization of the potential.

The profit of the use of fitness varieties is well-proven in scientists' works. In particular scientists [1] investigated the efficiency of aerobics programs, that are conducted by continuous and interval methods, with the aim of health promotion at the time of metabolic syndrome. Scientists came to the conclusion, that for people with low level of motive activity and metabolic syndrome, any program of aerobic training by duration of 16 weeks with frequency three times per a week is sufficient for improvement of health status. However, more intensive, but shorter aerobics program appeared less effective, that is why scientists did not recommend it for health promotion in this population group.

Scientists [2] offer the technology of application Body Pump training as an alternative to the traditional training with the large loading for overweight and obesity women. Researchers proved that this programme helps to promote metabolism and can be the same effective as well as traditional power training.

Also the comparative analysis of influence of aerobic interval and continual training on health status of people

with a metabolic syndrome made scientists [3]. During research the identical positive results were uncovered in reduction of average of arterial pressure, body weight and percent age of fat; it was discovered, that intensity of exercises was an important factor for the improvement of aerobic possibilities and removal of risk of metabolic syndrome factors.

During analysis of scientific publications it was found out, that most of them study the influence of efficiency of different fitness programs on health status of old age people or people with certain diseases. In spite of wide spectrum of researches the insufficient attention is paid to the study of health promotion problems of reproductive age women (first period of mature age), that should provide a sufficient birth-rate, but mostly are inclined to deterioration of health, because of certain physical, psychical and socio-economic confusions.

## THE AIM

Aim – to model, to ground and to check experimentally the efficiency of the complex organized system of fitness trainings and system of health improving trainings; to discover their influence on the status of women's somatic health of the first period mature age.

While formulating the hypothesis of the study, we proceeded from the assumption that the experimental program of fitness trainings for women of the first period mature age, which requires the organization of the systematic complex training process and provides the dosed doing of physical exercises under the trainer's guidance, will be more effective than the system of individual health improving self-trainings, however, both training systems will help to reduce weight and girth of body parts, formation of physical qualities (strength and flexibility), improvement of cardiovascular and respiratory systems, vestibular apparatus, working capacity, and, accordingly, improvement of women's somatic health.

## MATERIALS AND METHODS

Experimental work to verify training systems and women's somatic health required the application of theoretical and empirical research methods. Among the theoretical methods we have used: analysis, generalization, systematization, classification, pedagogical observation, direct questioning, modelling; among empirical were methods of putting the results of the study into practice (pedagogical experiment), methods of control and measurement, methods of data processing.

In order to develop the system approach to the study of the problem, the methods of analysis, generalization and systematization of literary sources were applied in the following stages: analysis of national scientific works, concerning the criteria of somatic health, standardization of motor activity, physiological negative changes of the organism caused by hypodynamics and positivity activities, as a result of optimization of motor activity; works related to health protection and fitness researches. The

classification method was used in order to investigate current types of fitness programs. Pedagogical observation was realized with the purpose of identifying the tools and techniques used by trainers while conducting fitness programs; monitoring the implementation of training systems that were proposed to women. Direct survey was organized to find out the motivations, needs, and problems of women of the first period mature age who are engaged in wellness fitness. The modelling method was used to design the complex organized system of fitness trainings for women of the first period mature age, optimal for their biological needs in motor activity, improving the functional status of their bodies and physical development. Pedagogical experiment was conducted as a specially organized research to test the effectiveness of the complex organized system of fitness trainings and the system of individual recreational health improving trainings for women of the first period mature age, to determine the status of women's somatic health before and after the experiment. The experiment involved 52 women aged 21-35 years who had no contraindications to active trainings, to significant motor experience (training experience from 0 to 1 year). Through random selection, participants of the experiment were divided into two groups (control and experimental), each of 26 people. The experimental group of women performed the tasks of the complex organized system, trained on the basis of various fitness clubs, and the control group did it at the place of residence.

## ORGANIZATION OF EXPERIMENT

In the first stage, literature sources were analyzed, the basic concepts of the research subject and the organization of the experimental work were grounded, the object, aim and objectives of the research were determined; women were questioned (motivation for training, needs, health problems were found out), primary check was performed on three indicators: physical development, functional status, level of general working capacity. On the basis of the obtained results the control and experimental groups were formed; the experimental fitness training system was designed to contribute to significant or effective improvement in the functional status, physical development and increase of the general working capacity of women of the first period mature age. The second stage of the research involved the implementation of the fitness training system, monitoring the fulfilment of the terms. In the third stage, the control check of women's health status on certain indicators was realized and the report was prepared.

In order to obtain credible data about the women's health in the course of the experiment we used complex evaluation and monitoring after the indicators:

1. Physical development (height, body weight, body's parts sizes), the formation of physical qualities (muscle strength of the abdominal abs (lifting the torso in a sitting position from the lying); flexibility (leaning forward from a sitting position). Tools: ruler, cales, stopwatch.
2. Functional status of women's body systems (cardiovascular, respiratory systems, vestibular apparatus). We

**Table I.** Indicators and levels of evaluation of the functional status of women of the first period mature age engaged in health fitness

Indicators and measurement units	Levels				
	high	sufficient	medium	satisfactory	unsatisfactory
Muscle Strength (quantity)	> 40	32	28	26	<24
Flexibility (cm.)	> 20	18	16	14	<12
Ruffier test (units)	0-4	5-9		10-14	15 i >
Stange test (sec.)	50	30-50		20-30	<20
Romberg's test (sec.)		> 30		15-30	< 15
Step test (units)	> 90	86-90	77-85	61-70	<60
PWC 170 absol. (kgm/min)	850	750-849	550-749	450-549	<449
PWC 170 relat. (kgm/min)	21-23	19-20	17-18	15-16	14
MCK (ml/min/kg)	>40	36-40	35-30	29-23	<23

evaluated the condition of the cardiovascular system using the Ruffier test, the respiratory system was characterized by the Stange test, and the condition of the vestibular system was verified through the Romberg's test. Tools: stopwatch.

Ruffier test technology: after 5 minutes of calm state in sitting position, it was necessary to calculate the heart rate for 15 seconds (result 1 – R1), then for 45 seconds women performed 30 squats. Immediately after that we calculated the heart rate for the first 15 seconds (R2) and last 15 seconds (R3) of the first minute of the recovery period. The results were evaluated by the index determined by the formula: Ruffier index =  $4 \times (R1 + R2 + R3) - 200/10$ .

Stange test technology: after 5 minutes of calm state in standing position it was necessary to measure the heart rate for 30 seconds, then hold the breath in full breath, previously breathe 3 times at 3/4 depth. The delay time was fixed in seconds. Immediately after breath recovery, the heart rate was again counted for 30 seconds.

Romberg's test technology: it is necessary to stand straight, with legs tightly held together, arms forward, fingers spread apart. At first, the test subject stands in such a pose with open eyes, then with his closed eyes. With a stopwatch, we recorded the delay time of women's postures of standing with their eyes closed without shaking.

3. The level of general working capacity was determined on the basis of the PWC170 test with the calculation of absolute and relative indicators and the Harvard step test. Tools: cycle ergometer, stopwatch, 43 cm high step platform, metronome.

We calculated PWC170 according to the formula:

$$PWC170 = W1 + (W2 - W1) (170 - f1) / (f2 - f1),$$

where: PWC170 is the strength of physical effort on a cycle ergometer at which the heart rate of 170 beats/min is reached; W and W2 are the power of the first and second loads, kgm/ min; f1 and f2 are the heart rates at the end of the first and second loads.

Harvard step test technology: for 5 minutes at a steady tempo, a woman went up and down the platform. The tempo was set by the metronome with a frequency of 120 beats per minute. The number of cycles (ascent-descent)

were 30 per 1 minute. After finishing it was necessary to rest for a minute. At the second, third and fourth minutes, we measured heart rate within 30 seconds, that is, three times for 30 seconds, followed by 30-second breaks.

To calculate the index we used the formula:

$$IHST = t \times 100 / (f1 + f2 + f3) \times 2$$

where: t is the test time, i.e. 5 minutes, f1, f2, f3 are the heart rates at the first 30 seconds of the second, third and fourth minutes of rest.

Statistical processing of the empirical data was performed with the calculation of t that is the Student's t-t test, the difference between the sample averages was accepted with 95 % probability (p < 0.05). Indicators and level so fevaluation of the functional status of women of the first period mature age engaged in health fitness submitted by table I.

## RESULTS

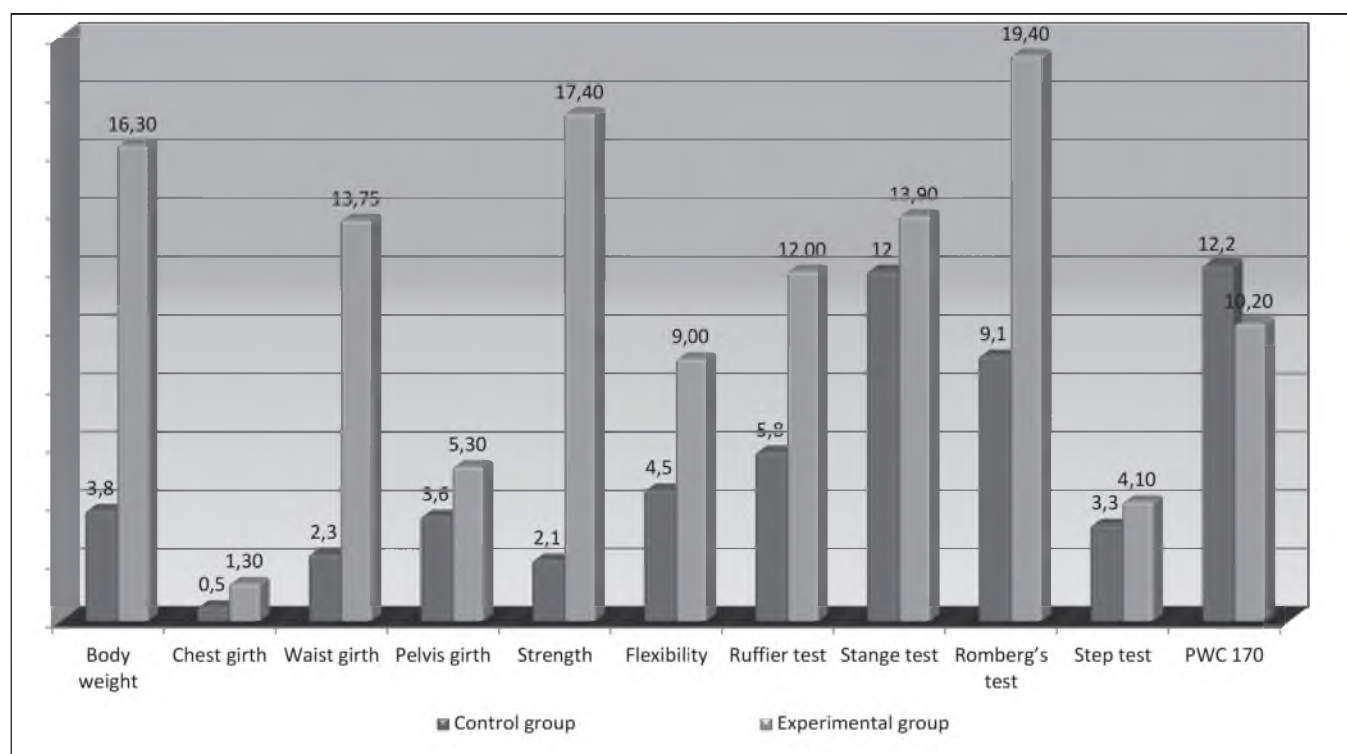
The analysis of professional scientific and methodological literature let to discover that fitness exercises completely satisfy the person's needs for physical activity, eliminate the effects of hypokinesia and are one of the most popular types of physical activity.

The most common classification of health fitness types is the systematization offered by Hawley E. and Franks B. Scientists divide health fitness into the following programs: aerobic and strength trainings; programs, which are based on the health types of gymnastics; water-based programs; recreational types of motor activity. The examination of fitness varieties proves that each of the programs contributes to the achievement of different goals (based on the formation of physical qualities): aerobic programs can increase overall endurance; programs, based on wellness gymnastics exercises (mental), influence on mobility of joints, relative static muscle strength; power programs contribute to the formation of power qualities and their derivatives; programs of recreational purpose help to realize the complex effect on the body, teach to combine the nutrition culture with healthy lifestyle. In accordance with the analysed classification, we can conclude that monodirectional classes do not hypothetically give the maximum result for health promotion, since a person requires the complex, system impact of physical



**Table II.** Comparative analysis of the condition of women of the first period mature age in the control (n = 26) and experimental (n = 26) groups before and after the experiment

Indicators, tests, measurement units	CG1 → CG2 M± m				EG1 → EG2 M± m				CG2 → EG2 M± m
	CG1	CG2	growth	P	EG1	EG2	growth	P	growth
Body weight (kg.)	67,6±2,1	65,0±1,96	3,8%	>0,05	68,1±2,15	57,0±1,0	16,3%	>0,05	12,4%
Chest girth (cm.)	94,1±3,8	93,6±3,7	0,5%	>0,05	95,9±4,15	94,6±3,9	1,3%	>0,05	0,8%
Waist girth (cm.)	76,3±2,7	74,5±2,1	2,3%	>0,05	78,5±2,95	67,7±0,82	13,75%	>0,05	11,4%
Pelvis girth (cm.)	97,8±4,2	94,3±3,9	3,6%	>0,05	97,9±4,2	92,7±3,6	5,3%	>0,05	1,7%
Strength indicator (times)	31,3±1,34	32±1,86	2,1%	>0,05	27±0,98	32,7±1,95	17,4%	>0,05	15,3%
Flexibility index (cm.)	12,6±0,95	13,2±0,78	4,5%	>0,05	14±0,86	15,4±0,96	9,0%	>0,05	4,5%
Ruffier test (units)	12,0±0,9	11,3±0,71	5,8%	>0,05	11,3±0,8	9,95±0,63	12,0%	>0,05	6,2%
Stange test (sec.)	33,2±1,9	41,6±3,06	12,0%	>0,05	36,5±1,7	42,4±3,1	13,9%	>0,05	1,9%
Romberg's test (sec.)	27,0±3,02	30,7±3,1	9,1%	>0,05	26,1±2,9	32,4±4,2	19,4%	>0,05	10,3%
Indicators of step test (units)	82,6±1,46	85,4±1,67	3,3%	>0,05	88,2±1,7	92±1,7	4,1%	>0,05	0,8%
PWC 170 absolute / relative (kgm/min)	707±74,7 / 17,2±4,06	805±78,3 / 21,4±6,2	12,2% / 19,3%	>0,05 / >0,05	726±76,8 / 17,4±4,2	810±79,8 / 21,1±5,9	10,2% / 17,5%	>0,05 / >0,05	-1,8% / -1,8%



**Fig. 1.** Dynamics of women's indexes formation status after realization of experiment in percentage

activity on different body's organs and systems. This is ensured by various fitness programs (aerobic, strength, mental orientation), compulsory rationing of physical activity during the week, systematic attendance of trainings. In our opinion, it is also important to take into account the trainer's recommendations about exercise techniques and diet.

Using the modelling method, we have developed the experimental complex system of fitness trainings for

women of the first period mature age, which implies the implementation of following conditions:

1. Systematic attendance of trainings at fitness club (three times a week) during 16 weeks.
2. Attendance of 50-60 min. duration multidirectional programs during the week, such as:
  - one aerobic program of choice: *Fitball Aerobics*, *Step Aerobics*, *Zumba* (or other dance program), *Combat*,

etc. The aim is to improve aerobic endurance, respectively – general working capacity, weight loss, reduction of girth dimensions;

- one power program of choice: *Body Pump*, *Legs*, *Cross Fit*, trainings in gym with a trainer, etc. The goal is to develop strength, endurance, increase of muscle mass, improve of muscle tone, figure correction;
  - one mental orientation program to choose from: *Yoga*, *Pilates*, *Mind Body*, *Body Balance* and so on. The aim is to improve flexibility, posture, vestibular apparatus.
3. Taking into account the trainer's recommendations on exercise technique, nutrition.

The recommended program for the control group offers women to participate in wellness and fitness activities that do not need regulated physical activity. Women individually selected activities that met their subjective needs and capacities. They performed trainings at convenient time, without taking into account the time of doing exercises, without outside guidance. Such activities included: smooth running, cross country running, swimming in the pool or in the open water, cycling (cycling tours), power exercising, or exercising on flexibility in training grounds.

During the experiment, 52 women aged 21–35 years (median age – 23.7 years) who had satisfactory health (main health group) and physical development (mean height 167.2 cm) were divided into two homogeneous groups. The testing indicators of women's condition in the control and experimental groups before and after the experiment are presented in Figure.1. in Table II.

Symbols: CG1 – control group before the experiment; CG2 – control group after the experiment; EG1 – experimental group before the experiment; EG2 – experimental group after the experiment; n – sample size; M – arithmetic mean; m – standard error of arithmetic mean; P – reliability of differences after Student's t-test.

## DISCUSSION

The criterion analysis of physical development, functional status and general working capacity of women of the first period mature age, that before the experiment did not have considerable motive experience, makes it possible to assert that the noted indexes can be found mainly on satisfactory and middle levels. After the end of experiment which was held (in the experimental group – the dosed, systematic, complex motive activity, guided by a trainer, and in the control group – individual trainings) for a long period of time (16 weeks), it was discovered, that positive changes in the status of women's health took place both in experimental (11.68 %) and in control (6.54 %) groups. In particular, the indexes of strength formation increased to the sufficient level both in experimental (17.4 %) and in control (2.1 %) groups; also positive changes took place and in the development of flexibility, with a preponderance of representatives of experimental group (9.0 %). Also positive changes can be seen in the functional status of the organism's systems of women, in particular most changes took place in the indexes of Stange test (CG2 – 12.0 %, EG2 – 13.9 %) and Ruffier test (CG2 –

9.0 %, EG2 – 19.4 %), that showed the improvement of the cardiovascular and respiratory systems' activity.

Differences in the formation level of physical capacity can be registered, in a greater measure, in the control group (PWC 170absolute – 12.2 %; PWC170relative – 19.3 %), comparatively with experimental (PWC 170absolute – 10.2 %; PWC170relative – 17.5 %). This fact can be explained by those women of control group, that were engaged in recreational types of fitness, elected mainly aerolateral types of motive activity such as running, swimming, wheeling, that assisted the increase of this index.

The decrease in body's parts sizes was also fixed both in control and in experimental groups: breast (CG2 – 0.5 %; EG2 – 1.3 %), waist (CG2 – 2.3 %; EG2 – 13.75 %), pelvis (CG2 – 3.6 %; EG2 – 5.3 %) and body weight (CG2 – 3.8 %; EG2 – 16.3 %), that assisted the correction of figure. In the course of investigation it was detected that technique, selected by us for verification of the condition of women's health turned to be suitable and effective.

## CONCLUSIONS

In the process of investigation it was succeeded to model, to ground and to check experimentally the complex organized system of fitness trainings and system of individual health improving trainings of women of the first period mature age, to realize the examination of efficiency of both systems in relation to the improvement of the status of somatic health. In general both systems of training assisted the decline of weight, decrease in body's parts sizes, formation of physical characteristics (strength and flexibility), improvement of the cardiovascular and respiratory systems' work, vestibular apparatus, increase of general working capacity that proves the efficiency of system approach to organization of trainings in this age-related group. It is important to notice advantages of the fitness programs under the leadership of trainer above individual trainings, that was more considerably represented on the indexes of development of strength and flexibility, body's parts sizes and body's weight.

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