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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Cardiovascular risk reduction in sedentary postmenopausal women during organised physical activity

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Abstract

Background: Cardiovascular (CV) diseases are a major cause of death in elderly women. Aerobic training improves component CV risk factors. Long-term, higher-intensity, group-based and home-based exercise training has been shown to improve exercise performance. However, it is not clear if short-term, group-based or home-based training with an educational programme permanently improves cardiometabolic parameters in elderly women.

Aim: The aim of the study was to evaluate the effectiveness of organised physical activity programmes dedicated to elderly, sedentary women.

Methods: Thirty-five sedentary women, aged > 55 years (mean 65.4 ± 7.3 years) were enrolled in a two-week group-based physical training programme of moderate intensity (2.5–5.0 METs) followed by three months of organised, home-based physical activity targeting all major muscle groups with special emphasis on postural muscles, combined with an educational programme about physical activity and CV risk. Eighteen months of self-guided physical activity was the final stage of training. Medical examination and blood samples were collected at baseline and after each step of exercises.

Results: Each step of training resulted in a reduction of systolic and diastolic blood pressure ($p < 0.05$), body mass index ($p < 0.05$), waist to hip ratio ($p < 0.02$), and low-density lipoprotein ($p < 0.05$) as compared to baseline. The time of exercise ($p < 0.01$), maximal tolerated load, and maximal oxygen consumption ($p < 0.001$) were significantly improved after two-weeks of training, as well as the high-density lipoprotein ($p < 0.001$). These changes remained significant after three months. Finally, the 10-year risk of fatal CV disease reduced significantly ($p < 0.05$). After 18 months 2/3 of subjects continued physical activity at a sufficient level to achieve additional health benefits according to the World Health Organisation.

Conclusions: Organised, group-based exercise followed by home-based training and self-guided physical activities constantly improves cardiometabolic parameters and reduces CV risk.

Key words: physical activity, postmenopausal women, metabolic syndrome, cardiovascular risk, exercise capacity

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INTRODUCTION

Aging is a physiological process, often accompanied by a reduction of physiological function, disability, and diseases. An important aspect of old age is the quality of life, assessed primarily based on psycho-motor skills and the ability to function in society.

Cardio-respiratory fitness (CRF) is a recognised indicator of a close relationship with the development of cardiovascular (CV) diseases (CVD), metabolic diseases (obesity, diabetes mellitus), certain types of cancer (breast cancer, colorectal cancer), mental disorders (Alzheimer's disease), mortality from CV and overall causes, and with the expected length of life [1].

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It has been shown that physical training effectively improves physiological functions of all ages. Reduction of maximal oxygen consumption (VO_2max) associated with aging in physically inactive people is several times faster compared with regular trainees, in whom no reduction of VO_2max has been observed for many years and the rate of reduction did not exceed 0.25 mL/kg/year [2].

Many studies have confirmed that sedentary postmenopausal women have a worse profile of cardiometabolic risk, as compared to moderately physically active women. Low physical activity is often accompanied by obesity and metabolic disorders, which in developed countries has risen to epidemic levels [3].

Central obesity and associated metabolic disorders (dyslipidaemia, impaired carbohydrate metabolism), and arterial hypertension constitute a set of factors, defined as metabolic syndrome (MS). Symptoms of MS are often accompanied by insulin resistance, impaired endothelial function, increased state of thromboembolic readiness and low cardiorespiratory efficiency. These factors lead to a 2–4-fold increase of the risk of CV events and mortality from cardiac causes [4].

From the point of view of the effectiveness of reducing morbidity and mortality from CVD, the greatest significance is given to health-oriented lifestyle changes, including regular physical activity, healthy nutrition, and reduction of tobacco and alcohol consumption. Insufficient physical activity is an independent risk factor for diseases of civilisation and is one of the biggest problems of health care in the twenty-first century. Among the interventions on lifestyle changes, exercise can reduce cardiometabolic risk, regardless of nutrition and medical treatments, leading to an increase in VO_2max. It is difficult to achieve the recommended volume of physical activity in the general population, and elderly people with MS generally have low cardiorespiratory efficiency [5].

It has been shown that there is a stronger relationship between CRF and the risk of developing CVD than between physical activity measured by energy consumption or time spent on physical exercise [6]. People with higher CRF, evaluated based on VO_2max measurements are characterised by more favourable anthropometric variables, metabolic profile, and lower risk of CVD, as compared to those with lower aerobic capacity. Regular physical activity resulting in increased cardio-respiratory efficiency may lead to health benefits through a positive impact on every single risk factor, as well as a group of interrelated risk factors.

Persons expending more than 2000 Kcal weekly during physical activity achieve reduction in the risk of death by 28%. In addition, a steady decline in mortality was observed for each additional 500 Kcal, up to 3500 Kcal weekly [7].

The aim of this study was to evaluate the effectiveness of short-term (two-weeks), medium (three-month), and 18-month organised physical activity (OPA) programmes, dedicated to elderly, sedentary women.

Table 1. Baseline characteristics (n = 35; mean ± SD)

Age [years]	64.7 ± 7.7
Height [cm]	157.9 ± 5.50
Weight [kg]	69.0 ± 12.2
BMI [kg/m^2]	26.4 ± 4.5
Fat mass [%]	37.1 ± 6.3
Waist circumference [cm]	89.5 ± 11.4
Hip circumference [cm]	104.6 ± 8.5
WHR	0.84 ± 0.07
Systolic BP [mm Hg]	132.6 ± 16.3
Diastolic BP [mm Hg]	78.0 ± 6.0
Heart rate [bpm]	81.1 ± 10.6
Glucose [mg/dL]	95.2 ± 17.8
Total cholesterol [mg/dL]	208.0 ± 41.7
HDL cholesterol [mg/dL]	64.1 ± 14.7
LDL cholesterol [mg/dL]	133.6 ± 43.2
Triglycerides [mg/dL]	84.1 ± 16.6
hsCRP [mg/dL]	0.34 ± 0.35

BMI — body mass index; BP — blood pressure; WHR — waist-to-hip ratio; hsCRP — high-sensitivity C-reactive protein; HDL — high-density lipoprotein; LDL — low-density lipoprotein; SD — standard deviation

METHODS

Thirty-five women aged 64.7 ± 7.7 years were recruited to the study. Inclusion criteria consisted of: female, age > 55 years, medical examination confirming lack of health contraindications for controlled exercise, and written, informed consent. Three individuals were excluded due to medical conditions significantly increasing the risk of participation in the OPA, as follows: 1) very low functional fitness, uncontrolled hypertension, coronary artery disease; 2) abdominal aortic aneurysm, atrial fibrillation; and 3) acute upper respiratory tract infection. Baseline subjects' characteristics are presented in Table 1.

Qualified participants were instructed to maintain their usual nutritional habits throughout the training period; no nutritional intervention was introduced. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Study design and exercise protocol

Prior to the beginning of organised, group-based physical activity (OPA), subjects were questioned about their health status by a medical doctor (baseline). A second examination was performed to measure the short-term effects within two days after two weeks of group-based training (Stage A), and next within two days after the three-month Prevent Falls in the Elderly Programme (PFEP) (Stage B) — post-training outcome, treated as intermediate-term effects. Venous fasting blood at rest for triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), glucose, and high-sensitivity C-reactive protein (hsCRP) was withdrawn after Stage A and Stage B. Low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald formula. The fourth examination was performed correspondently with a specific questionnaire to analyse the level of self-guided physical activity 18 months after self-guided physical activities.

Firstly, participants were subjected to the Active Leisure Time Programme (ALTP), which included two weeks of daily physical activities, performed three times daily in 40–75-min sessions, preceded by general warm-up activity, calisthenics, and stretching exercises conducted by a physical education instructor with specialisation in training older adults. Exercises were supplemented by additional social, educational, and motivational activities. In total, 39 physical activities were performed within two weeks. Exercise intensity was controlled by heart rate (HR), which ranged within 40–60% of maximal HR. Simultaneously, subjects controlled exercise intensity by ratings of perceived exertion (RPE) using the 6–20-point Borg scale. Participants were instructed that RPE should range between 8 and 15 points. 20% of exercise was ranked below 9 points, 70% within 10–12 points, and 10% of exercise was assessed within 13-15 points.

The two-week multicomponent exercise training programme was followed by the PFEP. A three-month programme of general fitness exercise was conducted with the main purpose of preventing falls in the elderly. The subjects were also encouraged to undertake self-guided physical activities. Regular activities were conducted in two sessions per week.

An 18-month period of self-guided physical activities was followed the PFEP. Physical activities were not limited, not prescribed, and not controlled.

The programme was previously described in detail by Żmijewski et al. [8].

Anthropometrics and physical fitness

Height and body mass were recorded using a portable stadiometer and balance weighting scales, respectively.

Aerobic capacity and exercise tolerance were measured on an electrically braked bicycle ergometer using an incremental exercise stress test. After a 3 min warm-up at a workload of 10 W the test was continued with 20-W increments every 2 min until reaching a limit of 75% maximal heart rate (HRmax = 220 – age in years) or refusal to continue. Participants identified perception of perceived exertion at the end of the test with the rate of RPE on the 6–20-point Borg scale.

Electrocardiography was recorded during exercise (CASE Value, GE Healthcare), and blood pressure (BP) was measured every 2 min by the Korotkow method. Oxygen consumption was estimated using the equation of Storer et al. [9].

Cardiovascular risk score

Cardiovascular risk for each subject based on gender, age, smoking, systolic BP (SBP), and total cholesterol was estimated using an interactive electronic version of HeartScore® for high-risk countries in accordance with the European Guidelines on Cardiovascular Disease Prevention in Clinical Practice [10].

Statistical analysis

Descriptive measures were calculated for all variables. Data were verified for normality of distribution with the Kolmogorov--Smirnov test. Variables that did not meet the assumption of normality were analysed with non-parametric statistics.

One-way analysis of variance or the Kruskal-Wallis test was used to compare means of continuous variables at baseline and after each training period. Bonferroni's test or the Wilcoxon rank test was used for post hoc analysis. The statistical level was set at $p \leq 0.05$. Statistical tests were performed with SPSS software (v. 17; SPSS Inc.)

RESULTS

Baseline characteristics are shown in Table 1.

As an effect of two weeks of ALTP and three months of exercise PFEP training, the main physical fitness outcomes such as the time of exercise, maximal tolerated load, as well as estimated VO_2max (Fig. 1) were significantly improved.

At the same time, a subjective sense of tiredness in effort remained at a similar level in the 13-point Borg scale (Fig. 1).

Heart rate at rest (HR) and resting diastolic BP (DBP) significantly decreased after two-week exercise intervention, and remained low after three months of training (Fig. 2). In addition, resting SBP significantly decreased after ALTP and was then further reduced after PFEP (Fig. 2).

Waist and hip circumferences of the subjects were substantially lower after ALTP and PFEP. These changes were reflected by improvements in the waist-to-hip ratio, which decreased after Stage A and remained low after Stage B (Fig. 3).

Similarly, body mass index (BMI) was reduced after ALTP and remained low after an additional three months of exercises (Fig. 3).

There were positive changes after OPA in the lipid panel as well. HDL increased significantly after two weeks and three months of training, when compared to baseline. Although there were no significant changes in fasting glucose level (not shown), TG and total cholesterol decreased significantly after ALTP and remained decreased after PFEP, when compared to baseline (Fig. 4).

Finally, 10-year calculated CV risk (HeartScore) was significantly reduced after two weeks of training and further improved after three months of PFEP (Fig. 5).

DISCUSSION

The aim of this study was to evaluate early (two weeks) and medium-term (three months) health effects achieved by

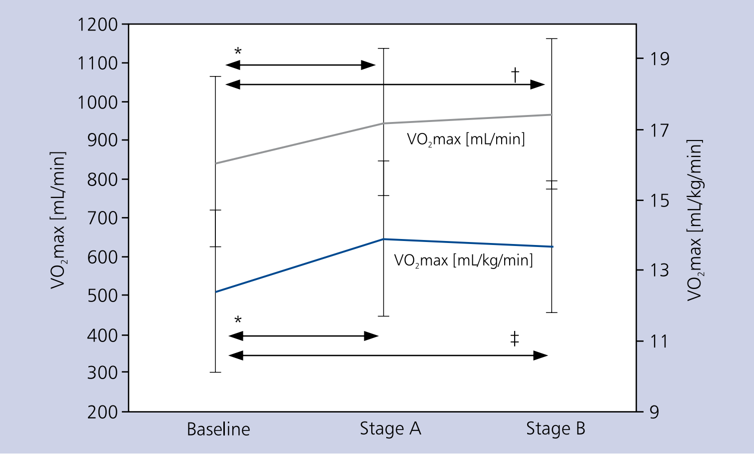

Figure 1. The level of physical work capacity at baseline, after two-week Active Leisure Time Programme (Stage A) and three--month Prevent Falls in the Elderly Programme (Stage B), expressed by maximum oxygen consumption (VO_2max); *$p < 0.001$; †$p < 0.05$; ‡$p < 0.01$

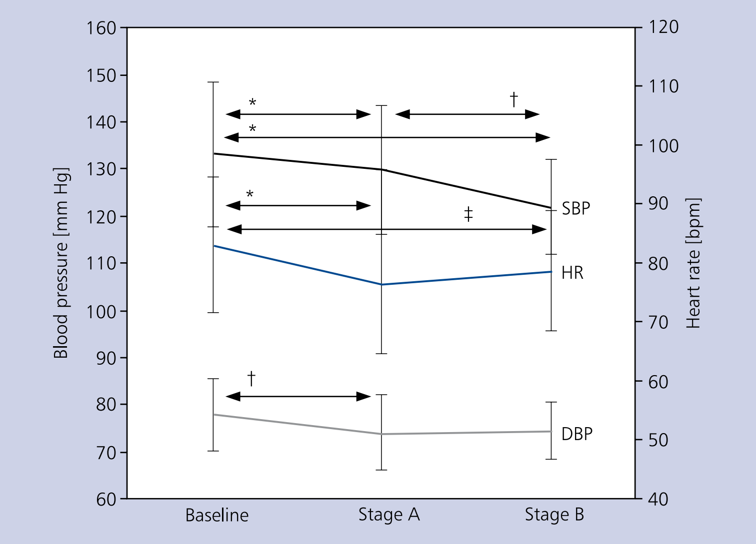

Figure 2. Heart rate (HR) at rest, systolic blood pressure (SBP), diastolic blood pressure (DBP) at rest and after two stages of organised physical activity; *$p < 0.001$; †$p < 0.05$; ‡$p < 0.01$

women over the age of 55 years participating in the OPA programmes. The assessment was based on an analysis of cardio-respiratory efficiency, indicators of the MS, and the estimated risk of CV events.

The main result of the study showed that elderly, sedentary women who joined an OPA, in a short time (two weeks), gained significant health benefits, such as positive somatic changes, and increase of physical fitness and aerobic capacity, a favourable modification of MS indicators, and reduced the absolute risk of cardiac events. Continuation of exercises, both in an organised and individual manner for the next three months, brought further positive changes in health indicators.

Participation in the programmes of OPA, which included health education and motivational workshops, also brought positive long-term effects; 73% of participants continued to exercise with an average of about 390 min per week (6.5 h per week) for another 18 months.

Among women over 55 years of age, who initially joined the OPA programme, risk factors for CVD were frequently found, or CVD was diagnosed, which in several cases was a reason to reduce the burden of physical activity or resign from continuation of the programme, due to the high risk of cardiac events. The reasons for disqualification from participation in the OPA were resistant hypertension with concomitant

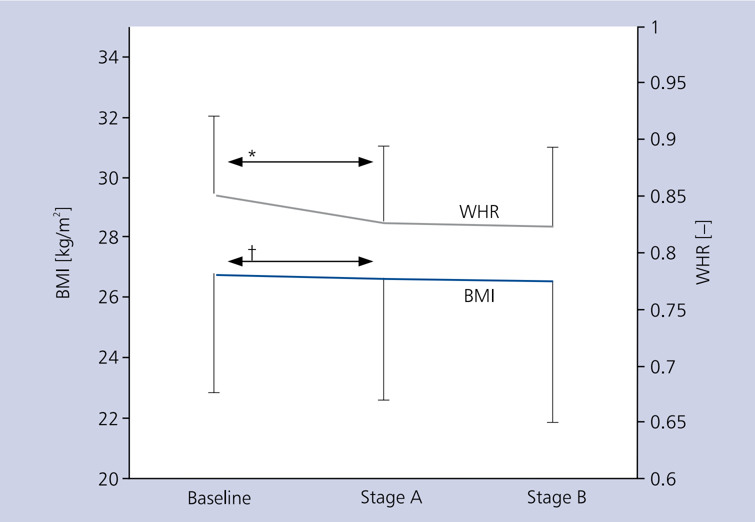

Figure 3. Waist-to-hip ratio (WHR) and body mass index (BMI) at baseline, after two-week Active Leisure Time Programme (Stage A) and three-month Prevent Falls in the Elderly Programme (Stage B); $*p < 0.02$; $\dagger p < 0.01$

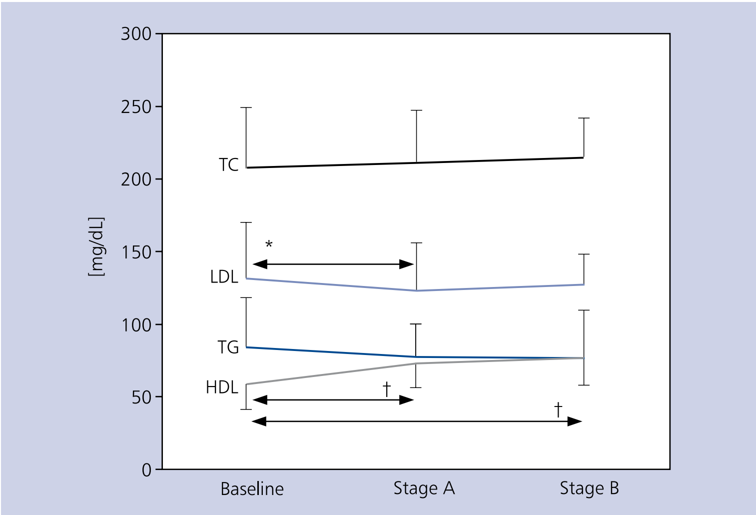

Figure 4. Lipid panel at baseline, after two-week Active Leisure Time Programme (Stage A) and three-month Prevent Falls in the Elderly Programme (Stage B); $*p < 0.05$; $\dagger p < 0.001$; TC — total cholesterol; TG — triglycerides; HDL — high density lipoprotein; LDL — low density lipoprotein

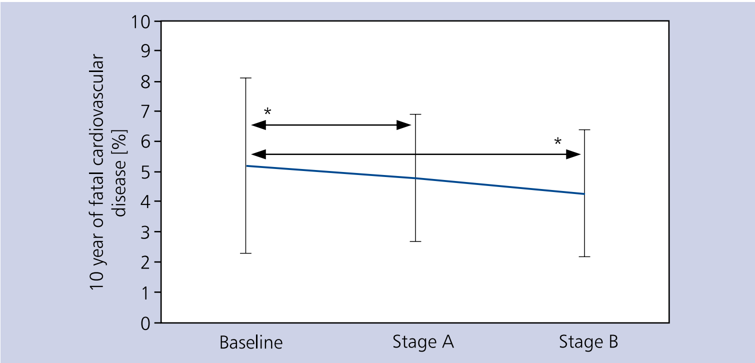

Figure 5. Calculated 10-year cardiovascular risk at baseline, after two-week Active Leisure Time Programme (Stage A) and three--month Prevent Falls in the Elderly Programme (Stage B); $*p < 0.05$. After 18 months from the end of the organised physical activity the average time spent on physical activity by participants of the programme was approximately 393 min/week

coronary artery disease, abdominal aortic aneurysm in patients with hypertension, and atrial fibrillation with inadequate anticoagulation therapy [8].

Somatic features

Prior to joining the OPA, median values of somatic indicators among participants showed overweight (BMI 26.8 ± 3.9), adiposity excess (fat 36.8 ± 6.2%), and central obesity (waist circumference 89.6 cm; waist-to-hip ratio [WHR] 0.85 ± 0.07).

Central obesity precedes the development of insulin resistance, significantly increases the incidence of type 2 diabetes and CVD (arterial hypertension, coronary artery disease), and increases the risk of cancer of the colon, uterus, breast, and kidney [11]. Visceral adipose tissue is hormonally and metabolically more active than subcutaneous adipose tissue. Adipokines released from the visceral fat, free fatty acids, or glycerol go directly to the portal circulation. In addition, the liver free fatty acids intensify processes of lipogenesis and gluconeogenesis, and proinflammatory adipokines stimulate the synthesis of CRP [11].

According to the definition of the International Diabetes Federation (IDF), central obesity is a key factor necessary for the diagnosis of MS [4].

It has been shown that the WHR and waist circumference are significantly positively correlated with the degree of risk of death from cardiac causes. Accordingly, the weight reduction substantially reduces the CV risk, correlating with a reduction in levels of CRP, glucose, TG, and LDL-C, leading to a reduction in risk of overall mortality [3].

Low physical activity is often accompanied by obesity. It is believed that the physical capacity substantially modifies the relationship between the amount of adipose tissue with morbidity and mortality from CVD.

After two weeks of training, OPA participants achieved a significant reduction of BMI, WHR, and waist circumference, while no significant changes in body weight and total body fat were recorded. The lack of change of the total fat content could be a result of the relatively small percentage of high-intensity exercise and the lack of a low-calorie diet, despite the relatively high total volume of exercise. Continued participation in OPA for the next three months did not cause further changes in weight and body composition.

Adipose tissue

The protective role of adipose tissue in the physiological metabolic state with high concentration of adiponectin and low levels of leptin, resistin, and proinflammatory cytokines is diminished at its excessive increase. In the state of abdominal obesity, visceral adipose tissue, in particular epicardial and pericoronary adipose tissue (PCAT), becomes a pro-atherogenic organ. PCAT may negatively affect the wall of the coronary arteries, leading to the development and destabilisation of atherosclerotic lesions [12]. It is known that the thickness of perivascular adipose tissue surrounding the coronary arteries (PCAT) correlates with the CV risk factors, as well as with the degree of coronary artery calcification. In the group of overweight patients with stable coronary artery disease, it has been also shown that the metabolic activity of PCAT measured in positron emission tomography positively correlates with the related coronary artery stenosis [13].

There is growing evidence that changes of the fat phenotype during obesity are at least partly reversible under the influence of positive lifestyle changes. It should be emphasised that physical activity is strongly negatively correlated with the volume of epicardial adipose tissue, regardless of BMI [14].

Lipid profile

The participants of the programme, after a two-week intervention, reported a significant increase in HDL-C level and a significant decrease in LDL-C level. After three consecutive months of physical activity a further, although not statistically significant, increase in HDL was observed. Before joining the training, in 1/4 of the participants decreased HDL levels were observed, while after three months of exercises HDL remained abnormally low only in one patient.

Cross-sectional studies in people over 65 years of age showed that the total physical activity (at work, in free time, and during recreational activities) was significantly positively correlated with HDL level, while there was no such dependence for total cholesterol, LDL-C, and TG [15].

The results of the current study confirm the data from the literature indicating that beneficial changes in HDL levels are possible through physical activity without concomitant use of a special diet. A meta-analysis of 25 experimental studies showed that the mean increase in HDL because of physical activity performed for no less than eight weeks was 2.53 mg/dL (95% CI 1.36–3.370) [16]. In addition, a significant increase in the levels of HDL was found when the energy expenditure for physical exercise exceeded 900 Kcal/week, and the effect was even greater when this expenditure exceeded 1200 Kcal/week.

The average increase in HDL in our study was much higher than that quoted by Kodama et al. [16]. It can be assumed that this effect was due to several reasons, of which the most important appears to be a programme of physical activity, systematic, daily physical exercise during the first two weeks and a further 4 h per week during the next three months. Participation in the OPA allowed for the reduction of LDL-C by about 4.6% in three months. Favourable changes in the concentration of LDL were also observed by other authors [17], in men and women participating in daily physical activity at moderate intensity, within three months. However, the evident effect of reducing LDL levels due to the physical activity is not clear.

Haemodynamic indicators of CV system

Another positive effect of OPA was favourable changes in haemodynamic indicators of the CV system, such as reducing the resting heart rate after two weeks of exercise ($p < 0.001$), and reducing BP. Controlled, moderately intensive physical exercise (50–75% VO_2HRmax) has a well-documented antihypertensive effect.

Baseline average SBP values were within the range of normal high arterial pressure (133 mm Hg) and met the criterion of elevated SBP as one of the MS factors. After the implementation of the two-week OPA there was a significant SBP reduction, and after a further three months additional significant reduction of SBP was observed. The baseline prevalence of elevated SBP was 49%, while after a three-month programme it was 20% of women. Mean DBP, which was optimal at the baseline (77.9 mm Hg), after two weeks of training was significantly reduced and after a further three months did not change significantly. The mechanisms responsible for the achievement of exercise-induced hypotensive effect are complex and multifactorial. The importance of the several should be emphasised, such as decreased activity of sympathetic autonomic nervous system and reduced secretion of catecholamine, improving endothelial function, increasing the vasodilatory effect, and reducing a peripheral resistance, increase insulin sensitivity [18].

It is also known that the development of hypertension is accompanied by excess body fat and mechanisms that are directly related to obesity, which include insulin resistance and diabetes mellitus. It has been demonstrated that BMI was significantly positively associated with SBP and DBP. Hypertension (≥ 140/90 mm Hg) occurred significantly more often in people who are overweight or obese than in people with normal body weight.

Cornelissen et al. [19] conducted a meta-analysis including 93 studies with a total of 5223 participants and found that the reduction in BP because of physical exercise resulted mainly from a decrease in peripheral vascular resistance. A hypotensive effect was observed after different types of exercises (aerobic, resistance, and isometric). However, the greatest antihypertensive effect was observed after aerobic exercise. The amount of time spent inactive remained positively correlated with elevated DBP also in the group of patients who met the quantitative criteria of physical activity [20].

This drug-free procedure for the treatment of hypertension, in which physical activity plays a crucial role, is justified both in cases of mild hypertension, as an exclusive treatment procedure, as well as in advanced forms of hypertension, as support for pharmacological treatment [21].

Cardio-respiratory fitness

The CRF is determined by age, body composition, genetic conditions, and to a large extent by physical activity. Aerobic fitness, expressed by the VO_2max, is strongly correlated with major CV risk factors, the risk of CV events, and mortality from CV causes and overall causes.

Men and women with low cardiorespiratory capacity exhibit a five-fold increased risk of death from CVD, as compared to those with high physical fitness level [6].

A significant negative relationship between physical fitness, expressed as the ability to perform work on an appropriate load, and the risk of cardiac events and/or premature mortality was also shown. In a population of 11,240 people (24% women), low exercise capacity was the strongest populational risk factor for death [22].

Women participating in the OPA were characterised by a very low aerobic endurance at baseline (VO_2max 11.8 mL/kg/min) and a low level of fitness (maximum load in an effort test of 55 W). After two weeks VO_2max increased significantly by 17% to 13.8 mL/kg/min ($p < 0.001$). The maximum load exercise test significantly increased of 28% to 66 W ($p < 0.01$) and 70 W, respectively.

In other studies it has been shown that among elderly, physically inactive women with low VO_2max at baseline, an increase in aerobic capacity during exercises occurs within the first few weeks, while a further increase is much smaller or absent.

It was also shown that the increase in VO_2max in elderly women depended mostly on increasing arterial-venous difference in blood oxygenation, while cardiac output remained not significantly changed, which suggests that the main effect of increasing aerobic capacity was the result of peripheral circulation adaptation. Conversely, in young women an increase in aerobic capacity depends more on haemodynamic adaptation of the CV system.

It was also shown that in elderly women cardiopulmonary capacity improvement may be limited by overweight or obesity. After the OPA, indicators of exercise capacity increased from very low to low, according to criteria developed in Finland for the elderly [2].

In addition, it was found that regular intense physical activity reduces the negative effects of other risk factors. Smoking men with arterial hypertension, dyslipidaemia, and high cardiorespiratory capacity lived longer than men without CV risk factors, leading a sedentary life, and with very low VO_2max [6]. In modern epidemiological studies, low physical cardio-respiratory fitness is considered the strongest risk factor, as compared with hypertension, high cholesterol, obesity, and a CV family history [23].

Metabolic syndrome

The prevalence of MS in various populations is not fully recognised. The incidence increases with age in both sexes. Some publications indicate that MS affects approximately 39% of men and 22% of women in the adult population of the United States. In the United Kingdom, among women aged 60–79 years, the estimated incidence of MS is 29%. A strong negative correlation was shown between the occurrence of MS and the incidence of physical activity in leisure time [24].

Physical activity during leisure time can reduce the risk of MS by 2/3, compared to people with sedentary lifestyles. Among the participants of OPA the baseline criteria of the MS were met by 40.6% of women. After two weeks of physical exercise, this percentage decreased to 18.7%, mainly due to the reduction of SBP and DBP and an increase in HDL. After another three months of physical activity the percentage of women meeting the criteria of MS stayed at 19%.

Patients with MS usually have reduced aerobic capacity, arterial hypertension, and metabolic disorders that increase the CV risk. Over 70% of this population dies from cardiac causes. Physical training improving VO_2max has a positive influence on all the components of MS. However, most people with MS do not exercise regularly and few of them reach the currently recommended level of physical activity [25].

Coronary risk

The baseline 10-year risk of death from cardiac causes among the participants of the OPA (absolute risk) was 5.2%, and in accordance with the classification of the Systematic Coronary Risk Evaluation-HeartScore it was a high absolute risk [8]. As a result of two weeks of OPA the absolute risk was significantly reduced to 4.8%, and after a further three months of exercise, to 4.2%. It was shown that a significant indicator differentiating CV risk is VO_2max.

After 18 months from the end of the OPA the average time spent on physical activity by participants of the programme was approximately 393 min per week, which exceeded the level recommended by the World Health Organisation (WHO) in 2010 (150 min per week). Such a good and rather unusual result can be explained by fact that participation until to the end of the OPA was seen among the most committed women, who carried out the exercise programme correctly.

Limitations of the study

In this relatively small, non-randomised trial the study group at baseline was its own control during and after the training programme. Nutrition habits, smoking habits, medications, and physical activity due to leisure activities may affect how the health indices respond to the increased physical activity. To decrease potential bias of nutrition habits changes, the participants were instructed to maintain their nutritional habits during the intervention programme.

CONCLUSIONS

As a result of participation in the OPA, elderly, sedentary women, with overweight or obesity, low aerobic capacity, low capacity of exercise, high incidence of factors of MS, and high risk of cardiac events achieved significant reductions in central obesity, increasing exercise capacity and aerobic capacity, favourable lipid profile modification, and a significant reduction in the absolute 10-year risk of death from cardiac causes, assessing both in the short term (two weeks) and medium term (three months). After 18 months from the end of the programme 2/3 of the respondents continued systematic physical exercise in the area recommended by the WHO. The analysed programme can be an effective part of primary and secondary prevention of CVD in elderly women.

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Conflict of interest: *none declared*

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Zmniejszenie ryzyka sercowo-naczyniowego wśród nieaktywnych fizycznie kobiet w okresie pomenopauzalnym podczas zorganizowanej aktywności fizycznej

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Streszczenie

Wstęp: Choroby układu sercowo-naczyniowego (CV) są główną przyczyną zgonów wśród starszych kobiet. Trening aerobowy poprawia składowe czynniki ryzyka CV. Wykazano, że długotrwały, grupowy trening fizyczny o dużej intensywności w warunkach domowych poprawia wydolność fizyczną. Nie jest jednak jasne, czy krótkotrwałe, grupowe szkolenia i trening w warunkach domowych z dodatkowym programem edukacyjnym trwale poprawiają parametry kardio-metaboliczne u starszych kobiet.

Cel: Celem pracy była ocena wpływu krótkotrwałego programu aktywności fizycznej przeznaczonego dla nieaktywnych fizycznie kobiet w okresie pomenopauzalnym na czynniki ryzyka sercowo-naczyniowego.

Metody: U 35 nieaktywnych fizycznie kobiet w wieku ponad 65 lat (średnia 65,4 ± 7,3 roku) zastosowano 2-tygodniowy trening fizyczny o umiarkowanej intensywności (2,5–5,0 METs), następnie przeprowadzono 3-miesięczną, zorganizowaną, domową aktywność fizyczną, nacelowaną na główne grupy mięśniowe, ze szczególnym uwzględnieniem mięśni posturalnych, połączoną z programem edukacyjnym dotyczącym aktywności fizycznej i ryzyka CV. Samodzielnie prowadzona, 18-miesięczna aktywność fizyczna była ostatnim etapem szkolenia. Badanie lekarskie i próbki krwi zebrano na początku badania i po każdym etapie ćwiczeń.

Wyniki: W wyniku każdego etapu ćwiczeń obserwowano obniżenie wartości skurczowego i rozkurczowego ciśnienia tętniczego ($p < 0,05$), wskaźnika masy ciała (BMI; $p < 0,05$), wskaźnika talia-biodra ($p < 0,02$) oraz lipoprotein o niskiej gęstości (LDL; $p < 0,05$) w stosunku do wartości wyjściowych. Po 2-tygodniowym treningu znamiennie wydłużył się czas wykonywania wysiłku ($p < 0,01$), maksymalne tolerowane obciążenie (VO2max; $p < 0,001$) oraz stężenie lipoprotein o wysokiej gęstości (HDL; $p < 0,001$). Te zmiany utrzymały znamienność statystyczną po okresie 3-miesięcznej domowej aktywności fizycznej. Ponadto 10-letnie ryzyko zgonu z przyczyn kardiologicznych istotnie się obniżyło ($p < 0,05$). Po 18 miesiącach od zakończenia programu 2/3 uczestniczek kontynuowało aktywność fizyczną na poziomie wystarczającym do osiągniecia dodatkowych korzyści zdrowotnych wg Światowej Organizacji Zdrowia.

Wnioski: Zorganizowany, krótkotrwały, grupowy trening z następowym domowym programem ćwiczeń fizycznych i samodzielnie prowadzona aktywność fizyczna trwale poprawiają parametry sercowo-metaboliczne oraz zmniejszają ryzyko sercowo-naczyniowe.

Słowa kluczowe: aktywność fizyczna, kobiety po menopauzie, zespół metaboliczny, ryzyko sercowo-naczyniowe, wydolność wysiłkowa

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