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Effect of Exercise on Body Composition, Lipid and Glucose and Blood Pressure in Women with Chronic Degenerative Diseases

Efeito do Exercício Físico Aeróbico Sobre a Composição Corporal, Lipidemia, Glicemia e Pressão Arterial em Mulheres com Doenças Crônicas

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Abstract

The purpose of this study was to analyze the effect of exercise training on body composition, lipid and glucose and blood pressure in women with chronic degenerative diseases. The research was composed by 21 women mean age 60.3 (±9.42) years old, that showed some chronic degenerative disease. Initially they were subjected to measurements of biochemical and anthropometric measurements, measurement of blood pressure at rest. After data collection a 12-week intervention was performed, and the exercise protocol was applied three times a week with one hour each session. At the end of the intervention, the patients were subjected to the same initial evaluations. The results showed that after 12 weeks there were no significant changes in anthropometric variable, although there was a decrease in body weight. When compared blood pressure date, there was a significant change in systolic blood pressure (133.33±10.00 mmHg vs 121.11 ±13.64 mmHg, $p<0.05$). The lipidic profile showed considerable reduction in the level of LDL and increase of HDL, having a significant decrease in total cholesterol levels (255.14 ±36.85 mg/dl vs. 235.63 ± 37.26 mg/dl, p<0.05), the triglycerides levels (195.24 ±74.72 mg/dl vs. 134.76 ± 47.40 mg/dl, $p<0.05$) and VLDL cholesterol (39.05±14,94mg/dl vs 26.95 ± 9.48 mg/dl, $p<0.05$). In addition, fasting glucose showed a significant decrease (133.59±69.92 mg/dl vs. 117.34 ± 68.71 mg/dl). At the end of the study it was possible to conclude that the aerobic physical exercise is a well recommended conduct for women that presented chronic degenerative diseases.

Keywords: Exercise. Chronic Disease. Primary Health Care.

Resumo

O objetivo do presente estudo foi analisar o efeito do exercício físico aeróbico sobre a composição corporal, lipidemia, glicemia e pressão arterial em mulheres com doenças crônicas. A amostra da pesquisa foi composta por 21 mulheres com idade média de 60,3 (±9,42) anos, que apresentavam alguma doença crônica. Inicialmente as participantes do estudo foram submetidos à mensuração de medidas antropométricas, exames bioquímicos e aferição da pressão arterial em repouso. Após a coleta de dados foi realizada uma intervenção de 12 semanas, sendo o protocolo de exercícios aplicado três vezes por semana, com uma hora de duração cada sessão. Ao final da intervenção, as pacientes foram submetidas às mesmas avaliações iniciais. Os resultados encontrados após 12 semanas de intervenção não demonstraram alterações significativas nas variáveis antropométricas, embora houve um discreto decréscimo no peso corporal. Quando comparado os dados da pressão arterial, houve alteração significativa na pressão arterial sistólica (133,33 ±10,00 mmHg vs 121,11 ±13,64 mmHg, $p<0,05$). O perfil lipídico apresentou reduções importantes nos níveis de LDL e aumento do HDL, havendo um decréscimo significativo nos níveis de Colesterol Total (255,14 ±36,85 mg/dl vs 235,63 ±37,26 mg/dl, p<0,05), triglicérides (195,24 ±74,72 mg/dl vs 134,76 ±47,40 mg/dl, $p<0,05$) e do VLDL (39,05 ±14,94mg/dl vs 26,95 ±9,48 mg/dl, $p<0,05$). Além disso, a glicemia em jejum apresentou redução considerável (133,59 ±69,92 mg/dl vs 117,34 ±68,71 mg/dl). Ao final do estudo podemos concluir que o exercício físico aeróbico pode melhorar as alterações metabólicas em mulheres com doenças crônicas.

Palavras-chave: Exercício. Doença Crônica. Atenção Primária à Saúde.

1 Introduction

Chronic diseases are of long duration and generally slow progression, being the main cause of mortality in the world[1]. The four main causes of mortalities include circulatory diseases, cancers, respiratory diseases and diabetes mellitus[2]. The lack of physical activity, smoking, inadequate diet, excessive alcohol consumption and emotional stress, are factors that represent complications of modern lifestyle, associated to these diseases or clinical problems[1,3].

One of the diseases caused by these factors is obesity, which can influence other risk factors, such as hypertension, diabetes, dyslipidemia, among others[4]. Furthermore, the presence of these diseases in the same individual can result in metabolic syndrome, a set of amendments, interassociating these relations is the presence of insulin resistance[5-8], being one of the largest responsible for cardiovascular events, including atherosclerosis and lesions in several organs[6,7,9,10].

The treatment and prevention of diseases, as well as health promotion actions, are the responsibility of a multiprofessional team of primary health care, composed of qualified and motivated professionals to carry out integrated actions[11].

A program of exercises can promote beneficial changes

in physiological, cardiorespiratory and metabolic patterns, being effective in the prevention and treatment of chronic diseases[7,12,13]. The improvement in lipid profile through physical exercise is being recommended as part of the treatment of these diseases[14]. Individuals with chronic degenerative diseases will obtain greater benefits with the regular practice of physical activity, this being planned, focusing on the improvement of their health status and taking into consideration his initial health state[10].

Women with chronic degenerative diseases will obtain greater benefits with the regular practice of physical activity, this being planned, focusing on the improvement of their health status and taking into consideration their initial health state[10.15]. It is reported that menopausal women who practice regularly physical exercises tend to have lower memory deficit, improves the mood and fewer somatic symptoms, in addition to promoting muscle strengthening, maintenance of the articular mobility and less accumulation of fat[16].

Thus, the purpose of this study was to analyze the effect of exercise training on body composition, lipid and glucose and blood pressure in women with chronic degenerative diseases.

2 Materials and Methods

2.1 Sample

The patients were indicated by the Basic Health Unit of t Jardim Morumbi of the city of Paranavai - PR. In total 26 women initiated the program who had clinical degenerative chronic diseases, such as diabetes mellitus type 2 and hypertension, in addition to other comorbidities, such as biochemical changes and on Body Mass Index (BMI), and the patients who were overweight or had obesity.

The patients presented no contraindication to performing physical exercise, approved by the doctor of UBS. They were guided and clarified how the study would be conducted, by signing an informed consent.

2.2 Procedures

Before the intervention began, all patients were subjected to laboratory examinations, which included measurements of total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), very low-density lipoproteins (VLDL), triglycerides, and fasting glucose.

For the measurement of blood pressure (BP) the protocol of recommendations of V Brazilian Guidelines on Hypertension[17] was followed, using the auscultatory technique, using a sphygmomanometer. The measurement was performed in the sitting position, always in the right upper limb, with the arm supported at heart level. The patients remained at rest for 10 minutes before checking, ensuring that they did not perform physical exercise, ingestion of coffee or smoked 1 hour before.

In the anthropometric assessment data were collected on height through the use of a stadiometer, where the evaluatee was in orthostatic position, feet united and barefoot, seeking to put in contact with the instrument to measure the posterior surfaces of heels, pelvic waist, scapular waist and occipital region, with the head oriented to the Frankfurt plane[18]. To the measurement of weight, a scale was used with a precision of 100 grams. With these variables it was possible to calculate the BMI. For the evaluations of circumferences, the Petroski protocol was used[18]. The waist circumference was measured with a tape measure, considering the lowest abdominal perimeter or midpoint between the iliac crest and the last rib. The abdominal circumference had as reference the abdominal region in its largest perimeter (usually on the navel). The Hip circumference was measured from the largest perimeter, taking into consideration the most voluminous portion of the buttocks, which is laterally located observing the pelvis and the trochanter. With these variables it was possible to calculate ration Waist/Hip.

At the end of the 12 weeks of intervention, the laboratory examinations, measurements of blood pressure at rest and anthropometric assessment were performed again on patients who remained in the program.

2.3 Training Program

The exercise protocol was applied three times a week on alternate days, with each session lasting an hour, during a period of 12 weeks. Before beginning each exercise session, the patients were subjected to verification of blood pressure, measured by a sphygmomanometer at the beginning of each session. They received permission to begin the exercise session if both the systolic blood pressure (SBP) and diastolic blood pressure (DBP) were below 140x90 mmHg, respectively.

The exercise program included aerobic exercises, including primarily the walk, performed with mild to moderate intensity. Initially stretching and warm-up of the postural muscles were carried out, with an average duration from 5 to 7 minutes. The main stage was predominantly aerobic exercises, walking, held between 30 to 40 minutes, being accelerated walk, maintaining a mild to moderate intensity (starting slowly and gradually increasing speed)[7]. In the end muscles stretching exercises and relaxation were performed, aiming at the return of the heart rate (HR) at rest and improving flexibility, with an average duration of 7 minutes.

2.4 Statistical analysis

The study results were expressed as mean ± standard deviation for quantitative variables. For comparison between the two moments (pretest and posttest) 't' test student was carried out, with a significance level of $p < 0.05$. It was also used the delta percentage (D%) to verify the differences pre-intervention and post-intervention in percentage terms.

2.5 Ethical considerations

The ethical aspects of research involving human beings

were respected (Resolution No. 196/96 -National Council of Health). This study was subjected to and approved by CEP - Committee of Ethics and Research of t Centro Universitário de Maringá, under the Protocol 317/2011, Opinion no.317/2011, CAAE 0323.0299.000-11. The participants signed the Informed Consent Form.

3 Results and Discussion

26 female patients of UBS of Jardim Morumbi of Paranavai - PR began in the research, reducing at the end of the study to 21 patients, discarding those that registered a lower rate of attendance to 80% in training sessions. 21 women with a mean age of 63.3 (±5.46) years were considered for the study, and their initial assessments according to the protocol (Table 1).

Table 1 - Anthropometric characteristics, blood pressure, lipid and glycemic profile of patients of the UBS of the Jardim Morumbi of Paranavaí-PR before the intervention.

Variables	Average ±SD	Minimum	Maximum
Age (years)	63.3 ±5.46	54	71
Weight (kg)	71.3 ±5.45	67.0	91.6
Height (m)	1.56 ±0.08	1.43	1.65
BMI (kg/m2)	29.6 ±3.16	26.1	34.5
Waist (cm)	91.8 ±7.55	77.9	99.7
Hip (cm)	101.4 ±8.91	86.1	115.0
Abdomen (cm)	100.6 ±7.33	86.9	108.7
WHR	0.91 ±0.12	0.77	1.16
Fasting blood glucose (mg/dL)	138.43 ±71.82	74.8	286.8
Total Cholesterol (mg/dl)	255.14 ±36.85	201.7	315.9
HDL-cholesterol (mg/dl)	50.39 ±7.31	41.0	64.0
LDL-cholesterol (mg/dl)	166.24 ±52.1	124.44	200.3
VLDL-cholesterol (mg/dl)	38.51 ±14.29	20.50	67.58
Triglycerides (mg/dl)	192.54 ±71.46	102.5	337.9
SBP (mmHg)	133.33 ±9.13	120	150
PAD (mmHg)	86.19 ±8.05	80	100

Source: Research data.

Analyzing the anthropometric variables, it was observed that the patients are overweight or obese, resulting in a mean BMI of 29.59 (±3.16) Kg/m². WHR assesses the presence of visceral obesity. It was observed the WHR average of 0.91 (±0.11), a value above the established as normal, being an indicator of health risk[19]. The values of arterial pressure at rest before the start of the intervention presented the systolic blood pressure of 133.33 (±9.13) and diastolic blood pressure 86.19 (±8.05).

In the biochemical evaluation average values were observed of fasting plasma glucose levels of 138.43 (±71.82) mg/dl, values considered high, because the reference above 126 mg/dl of glycemia in fasting, assessed twice, classifies the individual as diabetes mellitus type 2[20]. The levels of total cholesterol showed high values (255.14 mg/dl ±36.85), as well as LDL that showed an average of 166.24 (±52.1) mg/dl, average classified as high by the Brazilian Society of Cardiology[21], while the levels of triglycerides showed average values classified as borderline[21].

Physical exercise has demonstrated great benefits for health, being indicated for the prevention and treatment of chronic diseases. Aerobic exercises, such as walking, where the individual performs physical exercise of moderate intensity with a duration of at least 30 minutes, are of easy access to people and usually have no contraindications, besides promoting physiological changes, and in the functional capacity to the practitioner[22]. These improvements were seen in patients of UBS of Jardim Morumbi who participated in the walking oriented-program, showing improvements in anthropometric variables, blood pressure, blood glucose and lipid profile after intervention of 12 weeks.

After 12 weeks of intervention in the walking program, patients showed no significant reductions in the anthropometric variables (Table 2). Body weight showed a decrease of 1.46% (71.32 ± 5.45 kg vs 70.28 ± 5.55 kg), and as a consequence a reduction in BMI (29.59 ± 3.16 Kg/m² vs 29.17 ± 3.24 Kg/m²). The waist circumference and hip circumference showed a reduction of 2.56% and 2.23%, respectively. There was a reduction of 1.91% in the abdominal circumference (100.6 ±7.33 vs 98.66 ± 7.27), even slight, it is important because the increase in the abdominal circumference is associated with the occurrence of cardiovascular diseases.

Table 2 - Anthropometric characteristics of patients of the UBS of Jardim Morumbi of Paranavaí-PR before and after 12 weeks of intervention.

Variables	Average ±SD	Average ±SD	
	Pre	Post	Δ%
Weight (kg)	71.3 ±5.45	70.28 ±5.55	-1.46
BMI (kg/m2)	29.6 ±3.16	29.17 ±3.24	-1.42
Waist (cm)	91.8 ±7.55	89.47 ±7.26	-2.58
Hip (cm)	101.4 ±8.91	99.16 ±7.66	-2.23
Abdomen (cm)	100.6 ±7.33	98.66 ±7.27	-1.91
WHR	0.91 ±0.12	09.1 ±0.12	-0.34

Without significant difference between the pre and post-intervention ($p<0.05$, t test).
Source: Research data.

To check other studies with similar characteristics related to the intervention period and protocol of physical exercise, it can be noted that it was also not observed by the authors, significant reductions in body weight, BMI and waist, hip and abdominal circumferences[22-26]. Even though there are no statistically significant changes in these indicators, the results can be highlighted by the possible increase of lean mass

promoted by exercise and the reduction of fat mass[14,23,26].

Araujo et al.[27] found in their study significant reduction of body weight and BMI in the walking group, composed of 26 female patients of a Basic Health Unit. However, the results were obtained after 16 weeks, being carried out sessions four times a week, being possible to consider that a longer intervention may be sufficient to obtain significant reductions. However, it is worth mentioning that Colombo et al.[28] in their study with patients with metabolic syndrome after 12 weeks of walking, performed three times a week, found significant changes in BMI and waist circumference.

It is important to emphasize that the excess fat and body weight is accompanied by greater susceptibility of a variety of chronic degenerative disorders that elevate extraordinarily the indices of morbidity and mortality[7]. The best procedure to reduce and maintain the levels of body fat is performing permanent behavioral changes, such as the combination of an intervention associated with a nutritional orientation[23-26].

The most significant changes of this study were observed in biochemical evaluations and ratings of systolic and diastolic arterial pressure (Table 3).

Table 3 - Hemodynamic characteristics of patients of t UBS of Jardim Morumbi of Paranavaí-PR before and after 12 weeks of intervention.

Variables	Average ±SD	Average ±SD	
	Pre	Post	Δ%
Fasting blood glucose (mg/dL)	138.43 ±71.82	122.90 ±72.05	-11.22
Total Cholesterol (mg/dl)	255.14 ±36.85	235.63 ±37.26	-7.65
HDL-cholesterol (mg/dl)	50.39 ±7.31	53.04 ±6.48	5.25
LDL-cholesterol (mg/dl)	166.24 ±52.1	155.73 ±29.88	-6.32
VLDL-cholesterol (mg/dl)	38.51 ±14.29	26.86 ±9.20	-30.24
Triglycerides (mg/dl)	192.54 ±71.46	134.32 ±46.02	-30.24
SBP (mmHg)	133.33 ±9.13	120.00 ±13.04	-10.00
PAD (mmHg)	86.19 ±8.05	85.24 ±5.12	-1.10

*Significant difference between the pre and post-intervention ($p<0.05$, t test).
Source: Research data.

The blood pressure after an intervention program of 12 weeks of walking showed a reduction in systolic and diastolic arterial pressure at rest, and there was a statistically significant reduction in systolic blood pressure (133.33 ±9.13 mmHg vs 120.00 ±13.04).

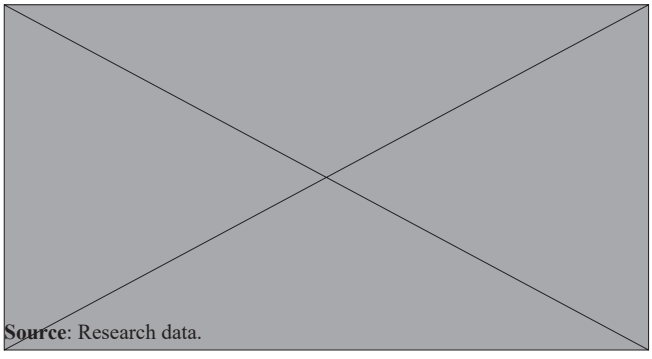
The reductions in blood pressure at rest can be justified in the literature on account of aerobic exercise providing the reduction of blood pressure at rest, suggesting that the aerobic exercises be performed with a frequency from 3 to 7 times a week, with duration of 30 to 60 minutes and moderate intensity of 40% to 70% of heart rate[7].

The improvement in blood pressure at rest was sketched in studies with aerobic walking exercises, and there was a statistically significant reduction in SBP and DBP in hypertensive patients[29], patients with coronary heart disease[22] and post-menopausal women[22,27,30].

Another similar result was verified in an intervention study of 16 weeks walk, where a significant reduction was observed in SBP after 12 weeks, while the DAP did not. But at the end of 16 weeks, significant reduction of PAD was also observed[25].

The effect of aerobic physical exercise goes beyond the reduction and maintenance of blood pressure, being associated with the reduction of cardiovascular risk factors[29]. It is highlighted that a program of individualized and supervised aerobic physical training may contribute to the increased functional capacity and for the control of arterial hypertension in women, especially those who are in post-menopause and consequently increases the risk of chronic diseases, then it is recommended as a therapeutic strategy complement in Basic Health Units[30].

Figure 1 - Means of SBP and DAP of patients of UBS of Jardim Morumbi of Paranavaí-PR before and after 12 weeks of intervention.



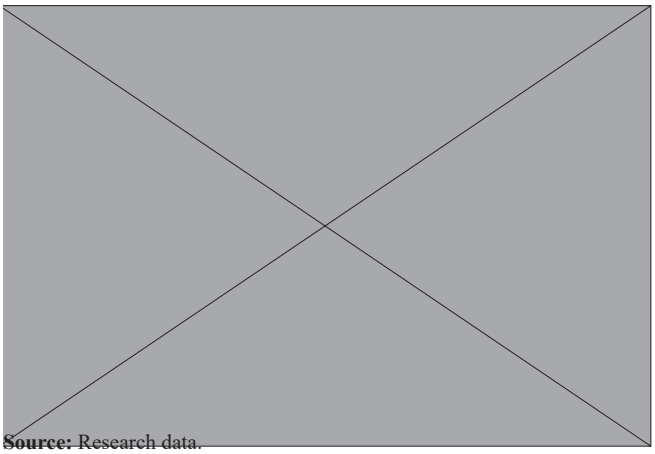
Source: Research data.

Analyzing fasting glycemia alone after the intervention, an important decrease was observed of 11.22% (133.59 ±69.92 mg/dl vs. 117.34 ± 68.71 mg/dl), justifying the beneficial effect provided by the exercise, such as the improvement of glucose uptake which increases during physical exercise, even with low insulinemic levels[31]. The prolonged moderate physical exercise increases the sensitivity of insulin receptors in muscles, producing the insulin-like effect which is accompanied by a greater eagerness of the cell by circulating glucose, ensuring a more economical work in the production of insulin and, in turn, improving the effectiveness in the control of glycemia[20], being possible to slow the progression of complications of diabetes mellitus, in the long term, such as atherosclerosis and the microangiopathies, due to the lower adhesiveness of platelets[31].

The improvement of glucose is associated with other studies[23,26], demonstrating improvements in glycemic profile of patients who have the same conditions. Some studies showed statistically significant changes in the reduction of glycemia[24.25], highlighting the efficiency of physical exercise

in reducing the levels of blood glucose. Even not presenting statistical reductions, we must highlight this reduction for a group of patients who are pre-diabetic or diabetic, as it was highlighted in studies that found no significant reduction of glycemia[22.27].

Figure 2 - Means of Blood glucose, total cholesterol, HDL, LDL, VLDL and triglycerides of patients of UBS of Jardim Morumbi of Paranavaí-PR before and after 12 weeks of intervention.



Source: Research data.

Regarding the lipid profile, it is known that low HDL level associated with elevated total cholesterol and LDL are associated with high risk of cardiovascular diseases[32]. Consequently, the increase of HDL and its apoproteins promote a protective effect important ranging from prevention to regression of atherosclerosis, regardless of cholesterol levels[7,32,33]. There are evidences that t physical training promotes increased plasma HDL and lower levels of total cholesterol and LDL, contributing to the reduction of the risk of cardiovascular diseases[34]. Aerobic training induces the most desirable changes in levels of plasma lipoproteins[7.13], and even it is possible to take into account that better effects can be obtained by combining physical exercise with changes in food habits[14].

LDL showed a reduction of 6.32% (166.24 ±52.1 mg/dl vs. 155.73 ± 29.88 mg/dl), although not significant, as well as in other studies[22,25,27]. However it should be noted that the average was previously classified as high, and after 12 weeks of aerobic exercises performed on a regular basis, the average lowered to a borderline classification[21]. HDL showed an increase of 5.25% (50.39 ± 7.31 mg/dl vs 53.04 ± 6.48 mg/dl), not significant, as well as in other studies[14,23,24,25,26], in which the authors suggested greater intervention time for better results. However, Soares and Teodoro[22] observed a significant increase in the average level of HDL (47.7±11.1 mg/dl vs. 58.5±7.6 mg/dl).

Upon comparing Total Cholesterol, a significant decrease was observed of 7.65% (255.14 ±36.85 mg/dl vs. 235.63 ± 37.26 mg/dl, $p<0.05$), as well as in other studies in which the patients underwent walking as intervention[14,22,23,24,27]. There are studies that even showing reductions in the levels of total cholesterol, significant changes were not observed[25.26].

The present study evaluated the level of VLDL, a lipoprotein subclass of large size, synthesized in the liver, which when released into the blood stream is converted into LDL, and values above the recommended increase levels of LDL causing damage such as the onset of atherosclerosis[35]. It was noticed in this study a reduction of 30.24% (38.51 ±14.29 mg/dl vs 26.86 ± 9.20 mg/dl) of VLDL-C. The regular practice of physical activity by diabetic patients provides the reduction of levels of VLDL[15]. The literature presents studies where there was a reduction in mean of VLDL after 12 weeks walking [22,27], and also papers where no statistically significant reductions were found [24,25,26].

The level of triglycerides showed a significant reduction. Before the intervention average was 192.54 (±71.46) mg/dl, mean value classified as borderline[27]. At the end of the 12 weeks of intervention, the triglycerides showed a decrease of 30.24%, resulting in a final average of 134.32 (±46.02) mg/dl, mean value classified as optimal[27]. Studies in the literature in addition to finding significant reductions only with the walking intervention recommend that aerobic exercise is efficient in reducing the levels of triglycerides[14,22-25,27].

The lipid profile showed improvement at the end of the intervention, reducing the levels of Total Cholesterol, LDL, VLDL, triglycerides and raising HDL levels after 12 weeks of a regular program of aerobic exercises, being performed with moderate intensity, which provided improvements in lipid profile, blood glucose levels in fasting, the reduction of body weight, compensation of arterial hypertension. In addition to these benefits, physical exercise promotes cardiorespiratory effects, reduction of stress, improved self-esteem, elevation of the VO_2max/kg and enhances the ability to perform activities of daily living[7.20]. Probably, these improvements could be more significant if there was a nutritional intervention.

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4 Conclusion

The intervention for women with chronic diseases through a regular program of aerobic physical exercise performed during a period of 12 weeks showed beneficial results for the treatment of these diseases. Although no significant changes in anthropometric variables were found, one must highlight the

reductions in circumferences, in body weight and consequently the BMI. The systolic and diastolic arterial pressure at rest also showed improvements. One should highlight mainly the reduction of levels of fasting plasma glucose levels, and the significant reductions in Total Cholesterol, VLDL and triglyceride levels, in addition to considerable changes in the decrease in the level of LDL and increased HDL level.

At the end of the study, we can conclude that the aerobic physical exercise is a well-recommended conduct for women with chronic diseases and should be performed on a regular basis and under the guidance of a physical education professional. For a future study a control group is suggested to evaluate and compare the effects of physical exercise in the trained group with the control group.

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