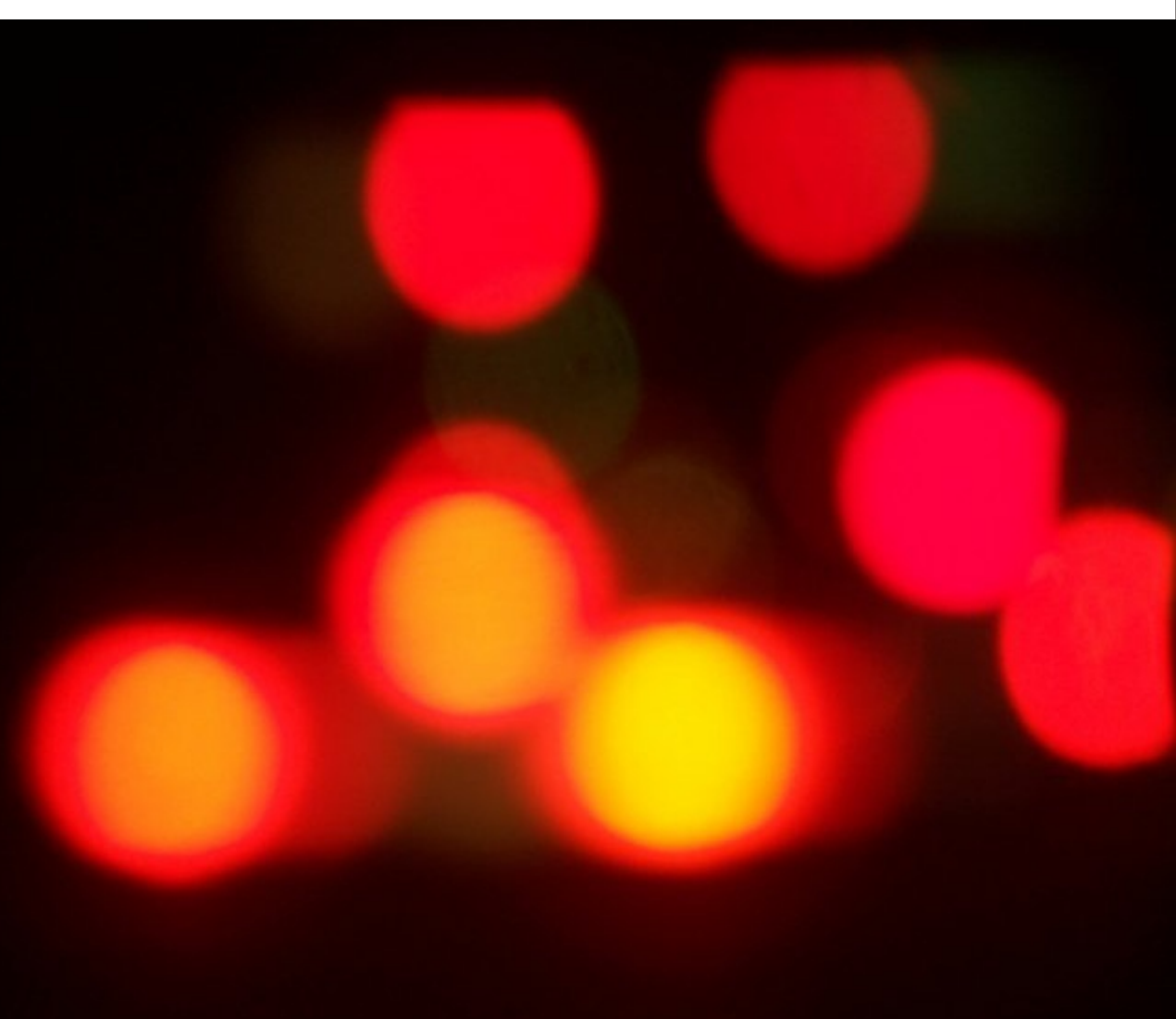


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# Aerobic exercise program on blood lipids in women between 40 and 55 years old

Judith M. Rodríguez-Villalobos\*, María de Jesús Muñoz-Daw, Rosa P. Hernández, Martha Ornelas

Faculty of Physical Education and Sport Sciences, Chihuahua Autonomous University, Chihuahua, México;

\*Corresponding Author: [judithrv@gmail.com](mailto:judithrv@gmail.com)

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## ABSTRACT

**Objective:** Evaluate the effect of a physical activity program on the blood lipid profile in women between 40 and 55 years old. **Methods:** 7 female participants from the city of Chihuahua, Chihuahua, Mexico, on a program of moderate-intensity physical activity lasting 4 months, evaluated before and after the implementation of the program in the variables of total cholesterol, triglycerides, LDL and HDL, as well as the atherogenic index and cardiovascular risk. Data were analyzed with Student t test for related samples with a significance level of 0.05. **Results:** Total cholesterol levels and LDL in samples collected after physical exercise program decreased significantly compared to those collected before the implementation of the exercise program, while statistically, HDL and triglycerides did not show significant changes. The atherogenic index and cardiovascular risk showed positive trends, thus favoring that moderate intensity aerobic exercise decreased cardiovascular risk in women reaching the perimenopause period.

**Keywords:** Lipids; Menopause; Exercise; Therapy

## 1. INTRODUCTION

Cardiovascular diseases are the main causes of death in women. Epidemiological studies show that menopause is associated with the prevalence of cardiovascular diseases [1]. In Mexican women, the average age of menopause occurrence is 49 years, due to the loss of ovarian follicular activity [2].

The hormonal deprivation produces changes in the lipid profile, increasing the quantity of total cholesterol

(TC), low density lipoprotein (LDL-C) [1,2] and decrease of high density lipoprotein (HDL-C) [3]. This modification in blood lipids is a risk factor in the contraction of atherosclerosis and other chronic degenerative diseases; this was observed more frequently in the post-menopausal period, causing deterioration in the quality of life and increase of morbidity and mortality [2,4-6].

The lipid problem has been increasing in our country, mainly in women who are older than 40 and to 69 years old, presenting higher values than men of the same age [7].

The most common treatments for women during this period are hormonal and/or drug therapy, however, the use of hormones as a monotherapy has not been evident in these conditions [4]. New studies involve a multidisciplinary approach in which the measures are directed to reduce the risk factors for cardiovascular diseases including obesity, abnormal blood lipids, hypertension, diabetes, smoking, sedentary lifestyle, genetic background effects, stress and estrogen deficiency [1].

Physical activity is acquiring more and more importance in being incorporated as part of an integral treatment. Benefits have been found in several studies, especially in lipids and other cardiovascular risk factors in women in perimenopause stage [8-11]. Among the published involvements there are still variations in the manner of applying the physical activity. On one hand, the level of intensity of the exercise has been given considerable importance, finding different benefits in the body, aerobic activity being the most recommended for the reduction of lipids and strength exercises being recommended for the management of osteoporosis [12-16]. Some studies concluded in favor of low-intensity exercise [17], others focused on vigorous exercise [18]. On the other hand, research such as Kraus argues that it is not the intensity level but the amount of exercise that

gets really beneficial results [19].

The present study proposes the implementation of a program of moderate-intensity physical activity (individually controlled), for an extended period of time, to assess its effect on the lipid profile in women who are in perimenopause stage. The study's objective is to generate and verify effective strategies to supplement existing treatment processes in the area of Chihuahua, Mexico.

## 2. METHODS

### 2.1. Design

Intervention study is with the same group as control. The individuals were evaluated in lipid profile at the beginning and the end of their physical activity program, which 4 lasted months.

### 2.2. Subjects

7 volunteer women who responded to a campaign by radio and press and who met the following inclusion criteria: age between 40 and 55 years old, without diabetes, with medical authorization to exercise and complete satisfactorily at least 80% of the sessions of the program. They attended an informative meeting and at the same meeting signed a letter of voluntary participation and answered the questionnaire Par-Q & You [20]. Participants were instructed to maintain their normal activities in their daily lives. The research committee of the Faculty of Physical Education and Sport Sciences at the Autonomous University of Chihuahua approved the research.

### 2.3. Variables

Independent variables: exercise program

The exercise program lasted a total of 66 sessions over 4 months, 4 times a week and 3 levels of intensity were used, gradually increasing at each level. They started the first 16 sessions at 40% of maximum heart rate, then increased to 50% the following 16 sessions, and the last sessions were programmed at 60%. The intensity at which they should perform physical activity was determined based on their heart rate reserve calculated by the Karvonen method [21], for this calculation we used the age and resting heart rate of the subject taken with the heart rate monitor after 10 minutes of remaining without any physical effort, the equation was used as follows:  $220 - \text{age}$ , the heart rate at rest is then subtracted from the result, and thus obtaining the so-called heart rate reserve; this number is multiplied by the degree or intensity that is going to be worked (40%, 50% or 60%), and to the result of this multiplication, finally we add the resting heart rate, and thus we obtain a heart rate at which the person must maintain during a minimum of 20

minutes for each session, with variations of no more than 5 beats above and below it. Their beats per minute were controlled using telemetric Polar heart rate monitors.

Dependent variable:

The variables observed were: lipid profile (total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein), the atherogenic index [22] (calculated by dividing the total cholesterol by high density lipoprotein) and the cardiovascular risk index [23] (composed of five components: age, total cholesterol, HDL-C, smoking and blood pressure). Variables were also measured to describe the general characteristics of the participants, which were: estradiol level, hemoglobin, weight and body mass index (BMI).

### 2.4. Procedure

In the beginning, participants were asked to provide a medical authorization document to affirm that they could exercise and were also asked to independently undertake a blood test to determine the level of estradiol which was issued by a certified laboratory, for women who still had menstrual cycle, the sample was taken in the twenty-first day of the menstrual cycle.

In the initial assessment overall variables were measured: body weight and height. A blood sample from the antecubital vein was taken while fasting to determine the lipid and hemoglobin profile; with the results of all these assessments a file was made.

We proceeded to the implementation of the program in which each session consisted of a warm up, between 10 and 15 min which included basic gymnastic exercises to warm up the joints and stretch the muscles, the core consisted of aerobic exercises for 30 to 40 min ranging from in motion gymnastic moves, to floor exercises, and routines, with and without hand held weights, which did not exceed 1 kg; the relaxation in the closing session lasted between 5 and 10 min with relaxed breathing and stretching exercises. Heart rate was monitored every 5 minutes making sure that in the core of each session people maintained their heart rate according to the programmed intensity.

At the end of four months, the lipid profile measurements were performed again.

### 2.5. Instruments

The instrument used for the measurement of body weight was a Torino brand scale and for the height it was a standing stadiometer fixed to the wall, using for both the technique of the International Society for the Advancement of kinanthropometry. With these values were calculated the BMI ( $\text{weight}/\text{height}^2$ ).

For the assessment of the blood sample, syringes or vacuum extraction system were used in the measurement

of the lipid profile. Blood was transferred to EDTA tubes and before a refrigeration of 2 hours the plasma was separated by centrifuging the tubes at 2500 rpm in a clinical centrifuge (IEC C300). The quantifying of the blood lipids was done by an automated analyzer (BTS-370 Bio system plus) with reagents of Bio system and enzyme-spectrophotometric techniques. HDL-C was measured before precipitation of Apo lipoprotein B (VLDL-C and LDL-C) with phosphotungstate and magnesium ions and before precipitating LDL-C with Polyvinyl sulfate and subtracting the value of the supernatant cholesterol of the total cholesterol.

The atherogenic index was obtained by dividing the total cholesterol by the HDL-C. The Framingham scale was applied to determine the cardiovascular risk index which is divided into five sections which are age, total cholesterol, HDL-C, smoking and blood pressure, the sum of the scores on each of the sections of the scale, is compared to the reference table, which results in the percentage of possibility of having a heart attack within 10 years.

## 2.6. Data Analysis

Statistical analysis was performed using SPSS version 15.0, to calculate descriptive data of mean and standard deviation for each variable. A comparison was performed between initial and final evaluations with t-test paired samples with a significance level of 0.05.

## 3. RESULTS

We evaluated seven participants who met the inclusion criteria including satisfactory completion of the physical

activity program with an attendance rate of over 80%.

At the time of starting the program, the average blood estradiol was found to be  $25.35 \pm 35$  pg/ml. One of the values was above 100 pg / ml, another at 26 pg/ml and the rest below; that is, 5 of the participants were in the postmenopausal stage and two in menopause, the average age group was  $48.14 \pm 5.11$  years, and had an average hemoglobin of  $13.95 \pm 1.72$ , the weight at the beginning had a mean of  $72.5 \pm 10.04$  kg and BMI was  $28.42 \pm 2.99$ , without significant variation throughout the program (**Table 1**).

In regards to the lipid profile, the initial average blood cholesterol was  $217.86 \pm 27.8$  mg/dl and after the program, there appeared a mean difference of  $35.57 \pm 25.62$  mg/dl, being a statistically significant change with a P value less than 0.01. Triglycerides data showed no significant differences, based on a mean value of  $228.5 \pm 168.78$  mg/dl, the average difference was  $57.18 \pm 92.97$  mg/dl (**Table 2**).

The LDL-C in the beginning was at an average of  $172.0 \pm 34.5$  mg/dl and after 4 months of the program there appeared significant differences with a P value less than 0.02, with the mean difference of  $28.24 \pm 25.33$  mg/dl. In HDL-C, we found no significant changes, with the initial average of  $35.5 \pm 3.48$  mg/dl and the mean difference was  $-0.63 \pm 6.56$  mg/dl (**Table 2**).

The atherogenic index in the beginning was  $6.2 \pm 1.1$  on average; the mean difference found was  $1.04 \pm 1.39$  not being statistically significant. The cardiovascular risk index calculated with the Framingham scale, in the beginning, was on average  $2.28 \pm 2.36$ , the mean difference in the end was  $1.00 \pm 1.82$ , with no significant differences between evaluations (**Table 3**).

**Table 1.** Descriptive data of mean and standard deviation for the general variables.

Variable	N	Mean	Standar Deviation
Age (years)	7	48.14	5.11
Estradiol (pg/ml)	7	25.35	35.00
Hemoglobin (g/dl)	7	13.95	1.72
Weight (kg)	7	72.50	10.04
Body Mass Index (kg/m <sup>2</sup> )	7	28.42	2.99

**Table 2.** Starting Mean, mean differences and significance of lipid profile.

Variable	Pre-Test (Mean $\pm$ SD)	Mean of Differences (d $\pm$ SD)	P
Total Cholesterol (mg/dl)	$217.86 \pm 27.84$	$35.58 \pm 25.62$	0.01
LDL-C (mg/dl)	$172.10 \pm 34.58$	$28.24 \pm 25.34$	0.03
HDL-C (mg/dl)	$35.58 \pm 3.48$	$-0.63 \pm 6.57$	0.81
Triglycerids (mg/dl)	$228.54 \pm 168.78$	$57.18 \pm 92.98$	0.15



**Table 3.** Starting Mean, mean differences and significance for atherogenic indices and cardiovascular risk.

Variable	Pre-Test (MEAN $\pm$ SD)	Mean of Differences (d $\pm$ SD)	P
Atherogenic index	6.19 $\pm$ 1.14	35.58 $\pm$ 25.62	0.09
Cardiovascular risk index	2.29 $\pm$ 2.36	57.18 $\pm$ 92.98	0.19

## 4. DISCUSSION

The participants reached a minimum of 80% attendance, maintaining during the programmed sessions a moderate intensity level, to obtain changes in the lipid profile.

The average age of the group of women who participated in the physical activity program agrees with the average Mexican woman marks of the official Mexican standard for the treatment of menopause. According to the estradiol blood values calculated in the study, 5 of them are in post-menopausal stage, being the reference point of less than 25 pg/ml.

The research focused on improving blood lipid levels, it was observed after 4 months that the total cholesterol reached  $182.3 \pm 23.3$  mg/dl, a value that is within suggested range according to the National Cholesterol Education Program US [24]. Similarly, LDL-C, significantly decreased, with a final value of  $143.9 \pm 26.4$  mg/dl but is still above the suggested range. The HDL-C, however, remained constant and triglycerides did not change significantly, which also occurred in the study of Janssen (2002) [13], who applied aerobic exercise combined with a diet and found no relationship between exercise, weight loss, decreased body fat and HDL-C, triglycerides and glucose.

On the other hand, the cardiovascular risks, determined by the Framingham scale showed a decrease of 10% in probabilities of getting a coronary problem within 10 years [24]. The same happened with the atherogenic index, which had a tendency to decrease although not significantly. In both measurements, the cause appears to be that the HDL-C remained relatively constant and well below the minimum required ( $>60$  mg/dl according to the NIH, 2002) [24].

The following considerations are: 1) The inclusion of a representative sample of women located in both pre and post-menopausal stage; 2) Following the diet meticulously; 3) Adding anthropometric measurements to estimate the distribution of body mass and weight since BMI alone may not be a good estimator of lipid risk. Consequently, it is suggested to include at least the measuring of waist circumference, which reflects on the lowering of visceral fat, and can relate most to the lipid changes.

## 5. CONCLUSION

In this study, an aerobic exercise program of moderate

intensity appeared to give benefits on the lipid profile of women in perimenopause who participated voluntarily in the city of Chihuahua, Chihuahua, resulting in a significant decrease in total cholesterol and LDL-C, but the HDL-C and triglycerides were not changed significantly. Considering the positive impact on the cardiovascular risk index and atherogenic index, the program may give rise to more widespread similar studies, and even promote its direct use in health centers as part of the strategies for treatment of this cluster of the population.

## 6. ACKNOWLEDGEMENTS

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