Effect of Moderate Aerobic Training on Hypertension in Obese Women

Abla M. Hamed* and Mervat Abd El-Rahman**
*Department of Physiotherapy for Cardiopulmonary Disorders and Their Surgery and Geriatrics, Misr University for Science and Technology.
**National Heart Institute.

ABSTRACT

Purpose: *The present study was conducted to determine the effect of moderate exercise training on obese women suffering from mild hypertension.* ***Subjects:*** *Fifty patients were selected from the outpatient clinic of the National Heart Institute. Their blood pressure ranged from 140-160 mmHg (systolic) and 90-100 mmHg (diastolic), their mean age was 55.87±2.37 years, their mean weight was 99.5±12.1 kilograms, their mean body mass index was 40.43±4.09 Kg/m^2, their mean waist circumference 89.34±7.4 cm and their mean height was 157.62±4.37 centimeters. They were divided randomly into two groups of equal number A and B, each composed of twenty five women. Women in group A were trained by using treadmill at 60% of maximum heart rate while, women in group B were considered as a control group. Both groups were instructed to take their regular medical treatment and resume their normal daily activities among the course of the study.* ***Methods:*** *Body mass index, waist circumference and resting blood pressure were determined for each patient individually, before and after treatment which was conducted 3 days / week for 3 months.* ***Results:*** *The results of the study after the suggested period of treatment revealed significant reduction of body mass index for both groups when compared with the pre treatment measurements. Significant reduction in resting blood pressure and waist circumference was observed in group A. However, no significant reduction was observed in resting blood pressure and waist circumference for group B.* ***Conclusion:*** *Aerobic training has great effects on resting blood pressure, body mass index and waist circumference.*

INTRODUCTION

Hypertension is defined as a consistent diastolic pressure of more than 90 mmHg and a consistent systolic pressure of more than 140 mmHg, measured on at least two occasions. It is commonly asymptomatic, readily detectable, and easily treatable. It often leads to lethal complications if left untreated[20].

Hypertension is particularly important in women because it is a modifiable risk factor for cardiovascular disease and extremely prevalent in older women community also, it is an important contributor to morbidity and mortality[1].

It has been reported that there is a higher prevalence of hypertension in old women than young women. After adjusting for body mass index, old women were still more than twice as likely to have hypertension as young women[16].

The mechanisms responsible for the increased blood pressure in old women included increased weight, decreased activity, reduced ovarian estrogen production, increased stress and increased sympathetic activation[1].

Obesity has been shown to result from a deregulation of food intake and energy expenditure rather than a loss of control over food intake[18].

Obesity in old women is accompanied by an increase in sympathetic activity, particularly in the kidney, leading to an increase in rennin release that could contribute to hypertension[17].

There are several different methods that have been reported to express the relationship of weight for height but the body mass index (BM1) which developed many years ago has become the most widely accepted way of assessment[11].

Diet, exercise, and behavioral modification form the cornerstones of treatment of obese hypertensive women. Relatively small weight loss results in improvement of all major aspects of obesity[5].

In obese patients, there is a decrease of as much as two mmHg of diastolic blood pressure for every 3 pounds of weight loss[6].

Low to moderate intensity of physical activities for most days of the week should be encouraged for all hypertensive patients to increase cardio-respiratory fitness, attenuate the abnormal rise in systolic blood pressure and protect against the associated health consequences[11].

These exercises may also reduce antihypertensive medication requirement. The antihypertensive effect of physical activity may persist for three months after exercise program[13].

Moderate intensity aerobic exercise training can lower blood pressure particularly in patients with stage one and stage two, essential hypertension. The average reduction in blood pressure is 10.5 mm Hg for systolic and 7.6 mmHg for diastolic blood pressure, which was not related to gender or age specific. The exercise training program for optimal benefits should consist of 3 to 5 times per week, 30 to 60 minutes per session, at 50% to 80% of maximum heart rate. However, exercise programs should be individualized to meet the patient's needs and abilities[7,14].

This study was performed to evaluate the effects of moderate aerobic training on blood pressure in obese hypertensive women.

SUBJECTS, MATERIAL AND METHODS

Subjects

Fifty obese females with essential hypertension represented the sample of this study. They were selected from the out patient clinic of the National Heart Institute. Their blood pressure ranged from 140-160 mmHg (systolic) and 90-100 mmHg (diastolic), their mean age was 55.87±2.37 years, their mean weight was 99.5±12.1 kilograms, their mean body mass index was 40.43±4.09 Kg/m^2, their mean waist circumference 89.34±7.4 cm and their mean height was 157.62±4.37 centimeters. All of them were considered hypertensive and obese from at least 4 years.

Women participated in the study were free from renal, neurological, heart disorders, chronic respiratory problems or severe orthopedic conditions, breast or endometrial carcinoma, coronary bypass surgery, deep venous thrombosis, uncontrolled diabetes or uncontrolled hypertension.

The participants were randomly divided into two equal groups each contained twenty five patients.

All participants in both groups signed a consent regarding the acceptance of participating in the program.

Group A (Study):

Twenty-five obese hypertensive women participated in training program using treadmill at 60% of maximum heart rate, three times/week for 12 weeks. All of them were under medical treatment. The training women received information regarding the benefits of

regular aerobic exercise, in the form of education session before starting the program; also, they were taught the signs of exercises limited end point (dizziness, dyspnea, palpitation, pallor, sweating, chest pain, and fatigue or leg claudication). All participants were informed about the nature and effects of the trial, and were asked to be on their normal daily activities and to avoid vigorous efforts and also continued to take routine medications.

Group B (Control):

Twenty-five matching obese hypertensive women were assigned as a control group and they were asked to be on their habitual activities. The participants were under their medical treatment.

Materials

For evaluation

- Mercurial sphygmomanometer (Health care): For measuring an average resting blood pressure.
- Pulsemeter: To measure and observe the pulse rate.
- Weight and height scale (Weighing ZT-120): For measuring and calculation of Body mass index (BMI).
- Tape measurement: For measuring waist circumference.
- Monitored treadmill (Life changing 250, made in Taiwan): For detecting a training heart rate which was calculated at 60% of maximum heart rate.

For treatment

- Treadmill (Life changing 250, made in Taiwan): For application of the training program.

Methods

For evaluation

- Blood pressure: From recumbent position the systolic and diastolic blood pressure were determined by the mercurial sphygmomanometer.
- Body mass index was calculated by dividing the obtained weight in Kg over height in m^2 [11].
- The waist girth was determined by using round measurement at half distance between the last rib and iliac crest[7].
- Each woman was asked to walk on the treadmill with a speed of 1.5 kg/hour and zero inclination for 2 minutes which increased to 3 kg/hour. The grade was increased by 2% every 2 minutes till reaching the exercise limited end point. The peak heart rate was then recorded by the pulse meter. Finally, the target heart rate for every woman was calculated at 60% of her peak heart rate[10].

Evaluation of the measuring variables was conducted before and after 12 weeks of the training program

For treatment

Each session of the treadmill training included three phases; an initial warm up phase for 5 minutes and an active aerobic phase at the prescribed target heart rate intensity. The phases started by short bouts, increased gradually up to 45 minutes at the end of the 12 weeks of treatment and final cool down phase for 10 minutes. If the participant was unable to perform the exercises continuously, a rest interval (2 to 3 minutes) was given to avoid fatigue or dyspnea. During the active phase she was instructed not to exceed her target heart rate (60% of peak heart rate). The exercise training was done three times per week for 12 weeks.

RESULTS

The raw data of body mass index (BMI), waist circumference (WC), resting systolic blood pressure and resting diastolic blood pressure were statistically treated to determine the mean and standard deviation of each measuring variable for the two groups A and B, before and after three months of treatment. Student's t-test was then applied to examine the significance of treatment conducted for each group.

- **Body mass index (Kg/m^2):**

Comparing the mean values of body mass index pre treatment indicated no significant differences between the two groups A and B. Significant improvement was observed when comparing the pre and post treatment mean values for groups A and B, separately. The mean values pre and post treatment for group A were 40.04 ± 4.62 Kg/m^2 and 35.16 ± 3.78 Kg/m^2, respectively ($P< 0.01$). The mean values pre and post treatment for group B were 40.81 ± 3.56 Kg/m^2 and 37.61 ± 3.86 Kg/m^2, respectively ($P< 0.01$). However, significant reduction was observed in favor of group A when comparing the post treatment mean values for groups A and B ($P < 0.05$). This represents a percentage of improvement of 12% and 8% for groups A and B respectively, table 1 and figure 1.

- **Waist circumference (cm):**

Comparing the mean values of waist circumference pre treatment indicated no significant differences between the two groups A and B. Significant improvement was observed when comparing the pre and post treatment mean values for group A . The mean values pre and post treatment for group A were 89.7 ± 8.9 cm and 84.4 ± 8.1 cm, respectively ($P< 0.01$). No significant improvement was observed when comparing the pre and post treatment mean values for groups B, were 88.99 ± 5.9 cm pre treatment and 87.5 ± 6.5 cm post treatment, respectively ($P>0.05$). However, significant reduction was observed in group A when comparing the post treatment mean values for groups A and B ($P < 0.05$), table 1 and figure 2.

- **Resting systolic blood pressure (mmHg):**

Comparing the mean values of resting systolic blood pressure pre treatment indicated no significant differences between the two groups A and B. Significant improvement was observed when comparing the pre and post treatment mean values for group A. The mean values pre and post treatment for group A were 161.55 ± 10.59 mmHg and 151.65 ± 8.77 mmHg, respectively ($P< 0.01$). No significant improvement was observed when comparing the pre and post treatment mean values for group B. The mean values pre and post treatment for group B were 162.65 ± 11.82 mmHg and 161.65 ± 7.89 mmHg, respectively ($P>0.05$). However, significant reduction was observed in group A when comparing the post treatment mean values for groups A and B ($P< 0.05$), table 1 and figure 3.

- **Resting diastolic blood pressure (mmHg):**

Comparing the mean values of resting diastolic blood pressure pre treatment indicated no significant differences between the two groups A and B. Significant improvement was observed when comparing the pre and post treatment mean values for group A . The mean values pre and post treatment for group A were 100.4 ± 6.57 mmHg and 93.6 ± 5.59 mmHg, respectively ($P< 0.01$). No significant improvement was observed when comparing the pre and post treatment mean values for group B. The mean

values pre and post treatment for group B were 101.05 ± 7.68 mmHg and 99 ± 6.4 mmHg, respectively (P>0.05). However, significant reduction was observed in group A when comparing the post treatment mean values for groups A and B (P < 0.05), table 1 and figure 4.

Table (1): Shows the pre and post treatment mean values of body mass index (Kg/m^2), waist circumference (cm) and resting systolic and diastolic blood pressure in group A and B.

Variables	Group (A)		Group (B)	
	Pre treatment	Post treatment	Pre treatment	Post treatment
BMI (kg/m$^{2)}$				
X ± SD	40.04 ± 4.62	35.16 ± 3.78	40.81 ± 3.56	37.61 ± 3.86
P- value	< 0.01		< 0.01	
WC (cm)				
X ± SD	89.7 ± 8.9	84.4 ± 8.1	88.99 ± 5.9	87.5 ± 6.5
P value	< 0.01		> 0.05	
Resting systolic BP (mmHg)				
X ± SD	161.55±10.59	151.65±8.77	162.65±11.82	161.65±7.89
P- value	< 0.01		> 0.05	
Resting diastolic BP (mmHg)				
X ± SD	100.4±6.57	93.6±5.59	101.05±7.68	99±6.4
P- value	< 0.01		> 0.05	

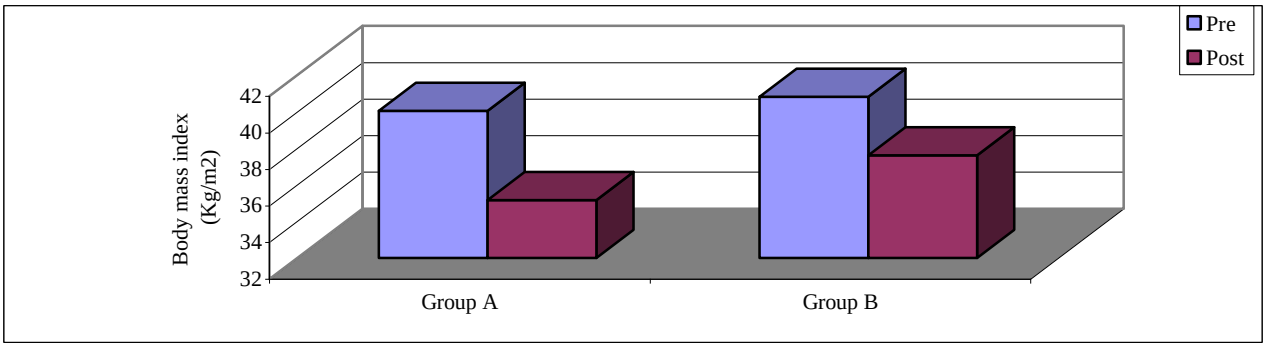

Fig. (1): Illustrates the pre and post treatment mean values of body mass index (Kg/m^2) in groups A and B.

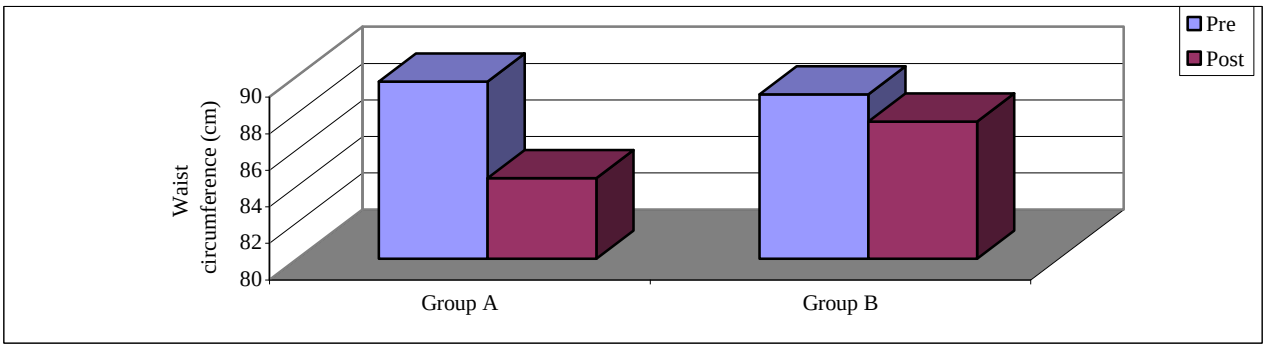

Fig. (2): Illustrates the pre and post treatment mean values of waist circumference (cm) in groups A and B.

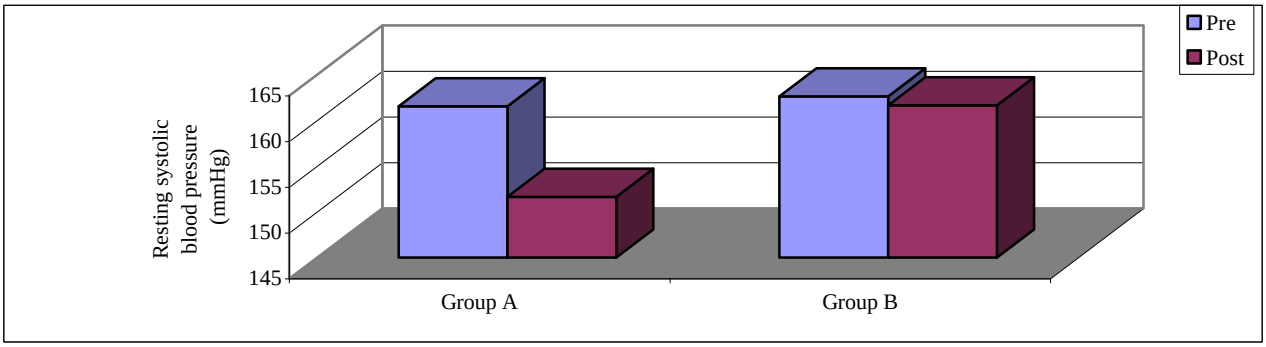

Fig. (3): Illustrates the pre and post treatment mean values of resting systolic blood pressure (mmHg) in groups A and B.

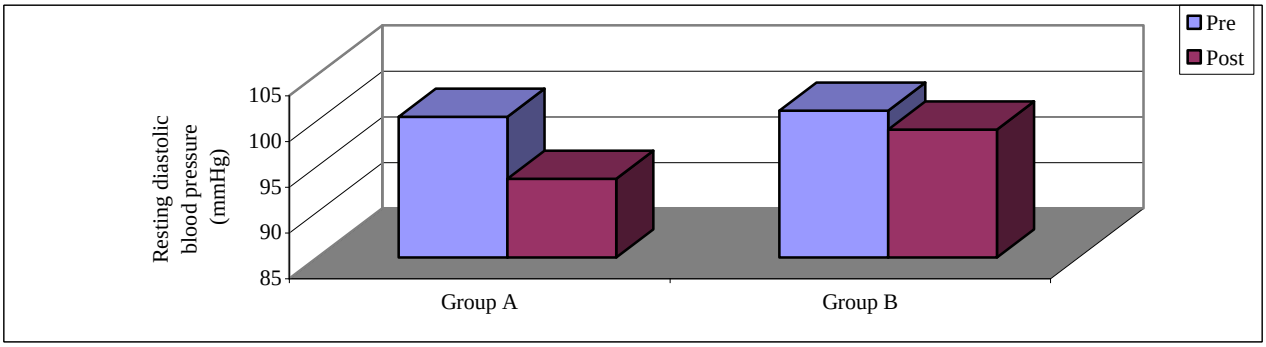

Fig. (4): Illustrates the pre and post treatment mean values of resting diastolic blood pressure (mmHg) in groups A and B.

DISCUSSION

Hypertension and obesity become increasingly common as the population become older, placing all hypertensive at high risk[12].

Exercise increases efficiency of the heart and lungs, decrease low-density lipoprotein (LDL) and triglyceride levels which decrease the risk for coronary artery disease. Changes in body composition cause a decrease in body weight if there is no compensatory increase in caloric intake[4].

In old overweight people, limitation of food produces a potent antihypertensive effect also, exercise and weight loss reduce blood pressure[8.]

This study was performed to evaluate the effects of moderate aerobic training on blood pressure in obese hypertensive women. The results showed that there was significant effect of aerobic exercise training on treadmill for 12 weeks in obese women with hypertension.

In the current study, there were significant reduction of body mass index (BMI) and waist circumference (WC) in group (A), while in group (B) there was no significant change regarding the waist circumference and significant reduction in BMI. Concerning the BMI, there was significant reduction in group (A). This may be due to fatty acid mobilization and oxidation from adipose tissue which is generally considered a predominant source of fuel in

working muscles, particularly during long term exercise.

Concerning the BMI, the results of the current study come in agreement with Maiorana et al.,[15] who reported that there was reduction in BMI after aerobic training as cycle ergometer leading to increase energy expenditure.

The results of the current study come also in agreement with, Hinderliter et al.,[9] who concluded that aerobic exercise on obese hypertensive patients led to loss of weight and decreased in body mass index because exercise training is a major modifiable component of total daily energy expenditure in old individuals. That is due to decrease in total amount of stored calories as a result of a negative energy balance, so that exercise produces decrease in energy intake leading to a reduction in body weight.

The results of the study confirms the findings of Compbell and Rossner[5] who found that exercise on obese diabetic patient causes a long term weight loss and decrease in body mass index. They revealed this loss to regular physical activity which enhance fat oxidation and partially prevent the age related increase in central body fatness.

Regarding the resting blood pressure, of group (A), the mean values of resting systolic and diastolic blood pressure were significantly reduced by (6.52 %) and (7.26%) respectively ($P<0.05$). While, in group (B) there was non significant decrease. This significant reduction of resting blood pressure shown in group (A) may be attributed to the increase in cardio respiratory fitness and induced favorable change in left ventricular wall structure. This leads to decrease in stroke volume and left ventricular end diastolic volume, which in turn leads to decrease in blood pressure[9,14].

These results agree with Vriz et al.,[19] who reported that short term aerobic exercises can decrease blood pressure and blood glucose level through improvement of insulin resistance in obese sedentary African women. Also, Blumenthal et al.,[2] proved that aerobic exercise has a reducing effect on blood pressure because exercises reduce peripheral resistance and decrease cardiac out put (COP). The decrease in COP with moderate endurance training could be a result of an increase in arterio-venouse oxygen difference reflecting greater oxygen extraction by tissues. The trained muscles have approximately 50% capillary to fiber ratio, these existing capillaries open up more.

The results of the current study support the findings of Brown et al.,[3] who established that aerobic exercise on obese hypertensive patients lead to suppression of sympathetic nervous system activity, which is more pronounced in hypertensive patients than in normotensive individuals. The changes in total dopamine from 0-2 weeks were negatively related with changes in diastolic blood pressure. The changes in systolic blood pressure were positively correlated with the changes in total nor-adrenalin in the same period.

The post treatment results confirm the findings of Kokkinos and Papademetriou[13] who reported that the exaggerated blood pressure response during physical exercise in hypertensive patients was also reduced by training. Exercise induced reduction in resting BP and prevention of abnormal increased in BP during physical exertion can lead to fewer cardiovascular events. This was also proved by the result of this study with a significant decrease in the elevated systolic and diastolic blood pressure directly post exercise. In this study a moderate intensity was chosen as it has more wide safety margin.

Conclusion

Treadmill training is important for obese hypertensive women as aerobic exercise has a positive effect on decreasing blood pressure.

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الملخص العربي

تأثير التدريبات الهوائية المتوسطة على ضغط الدم المرتفع لدى السيدات البدينات

تبحث هذه الدراسة تأثير التدريبات الهوائية المتوسطة على ارتفاع ضغط الدم لدى 50 من السيدات البدينات تم اختيارهم من العيادة الخارجية بمعهد القلب القومي والذي كان متوسط أعمارهن 55.87±2.37 عام ، متوسط أوزانهن 99.5±12.1 كجم وكذلك متوسط ضغط الدم لديهن يعادل 140-160 ملي متر زئبقي أثناء الانقباض البطيني و 90-100 ملي متر زئبقي أثناء الانبساط البطيني . وقد تم تقسيمهم عشوائيا إلى مجموعتين :المجموعة الأولي (أ) احتوت علي 25 سيدة تم تدريبهم على السير الكهربائي بشدة 60% من معدل ضربات القلب القصوى لمدة ثلاثة أشهر وكذلك اعتبرت المجموعة الثانية (ب) مجموعه ضابطه بدون أي تدريبات وقد التزمت المجموعتين بالعلاج الدوائي والنشاط اليومي المعتاد خلال فترة الدراسة . وقد اشتملت القياسات التي أجريت لكل مريضه قبل وبعد البرنامج العلاجي على :معامل كتلة الجسم ، ضغط الدم ومعدل دوران الوسط . وقد أظهرت هذه التجربة نتائج ذات دلاله إحصائية عالية عند مقارنه نتائج ما قبل وبعد البرنامج العلاجي في صورة انخفاض في ضغط الدم المرتفع ،معامل كتلة الجسم وكذلك معدل دوران الوسط في المجموعة (أ) دون وجود أي فروق إحصائية في المجموعة (ب) لهذه القياسات . ومن هنا يتضح أن استخدام التمرينات المتوسطة الشدة على جهاز السير الكهربائي له تأثير ايجابي على انخفاض ضغط الدم في السيدات البدينات .