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Effect of Aerobic Regular Exercise Training on Blood Pressure Control for Patients with Hypertension

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Abstract: Background: Hypertension affects over 26.3% of the Egyptian population and is considered one of the most significant risk factors for morbidity and mortality from coronary heart disease, chronic renal failure, and stroke. Lifestyle modification especially physical exercise is a mainstay in the management of blood pressure control. **Objective**: We sought to assess the effect of graded walking exercise on blood pressure in hypertensive patients **Methods:** Our study comprised 40 hypertensive patients with mild to moderate hypertension divided into 2 equal groups. Group I (experimental group) patients were given pharmacological medications and encouraged to graded walking exercise program and followed-up by the researchers over a period of eight weeks. Group II (control group) patients were given standard pharmacological medications only. **Results:** The results showed insignificant difference between GI and GII in their weight and BMI on 2nd, 6th, and 8th weeks comparing with 1st week. A non-significant improvement between GI and GII was found in heart rate as a short term effects through walking exercises. (t = 2.03, *p*= 0.05). Comparing between group I and group II regarding the benefits of walking program exercises on heart rate, systolic, and, diastolic blood pressure; a statistical significant difference was observed on 4th, 6th, and 8th weeks in relation to heart rate (p value = 0.0001, 0.005, and 0.0001), respectively, systolic blood pressure (p value = 0.0001, 0.006, and 0.0001), respectively, and diastolic blood pressure (*p* value = 0.009, 0.024, and 0.002) respectively. **Conclusion:** The results of the study strongly support the beneficial effect of aerobic regular exercise in reduction of systolic & diastolic blood pressure and heart rate in hypertensive patients with pharmacologic treatment. Special attention should be paid to aerobic exercise for hypertensive patients and should be integral component of hypertension education program.

INTRODUCTION

Hypertension is a widespread health problem effecting approximately 1 billion people worldwide and 1 out of every 6 persons on earth[1,2]. In EGYPT, high blood pressure is prevailing among 26.3% of the population[3]. The importance of treating this “silent killer” lies in its associated risk to cardiovascular disease, the number one cause of death, as well as other

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diseases including renal disease, stroke, heart failure, and peripheral artery disease[4,5].

Although hypertension is defined as systolic blood pressure (SBP) equal to and greater than 140 and/or diastolic blood pressure (DBP) equal to and greater than 90 mmHg. The new classification of “pre-hypertensive” (SBP 120-139 and DBP 80-89 mmHg) has been introduced to identify individuals who are at a higher risk of developing hypertension, pointing out an important fact that hypertension is a modifiable risk factor[6,7]

However, recent hypertension guidelines recommend treatment targets of 140/85 mmHg or below, international community based surveys show that in many countries only a minority of people treated for hypertension are controlled to these levels[8]. Many national guidelines for the prevention and treatment of hypertension recommend lifestyle modifications in the form of 'regular aerobic exercise, as well as a reduction of dietary sodium intake, and weight loss.[9]

Exercise as a lifestyle modification referred to a non-pharmacological therapy, It is beneficial to a wide variety of health conditions. Most experts consider walking one of the most appropriate aerobic activities. It is simple and requires no special skill, setting, or equipment other than a good pair of shoes.[10]

Most exercise prescriptions for hypertensive patients include duration of 20-60 minutes of aerobic exercise performed 3-5 times a week[11] Recent guidelines from the Department of Health suggest that each individual should participate in minimum of 30 min of

moderate intensity activity at least 5 days a week. A frequency of three exercise sessions per week has been considered to be the minimal frequency for blood pressure reduction[12].

The beneficial effect of regular exercise in hypertension is not limited to reduction of systolic and diastolic blood pressure only, It has also been shown to reduce left ventricular hypertrophy, improve exercise capacity, and quality of life.[3,14] When combined with dietary alterations, regular exercise causes reduction of oxidative stress, increases nitric oxide availability, and improves the overall metabolic profile.[15]

The responses to acute bouts of exercises are the physiological changes that occur within only a few exercise sessions, whereas the chronic adaptations are derived from the accumulation of several continuous exercise bouts over a period of time.[4]

A recent meta-analysis supports this chronic role being partially explained by a decreased systemic vascular resistance in which the autonomic nervous system and renin-angiotensin system are most likely the underlying regulatory mechanisms[16]. Another factor contributing to this decrease in vascular resistance is the increase of nitric oxide production causing a vasodilatation in response to regular aerobic exercise.[4]

Regular exercise reduces blood pressure by increasing circulation to the muscles and skin, and widening the arteries. It also improves renal function, which contributes to the body's ability to regulate and eliminate excess fluids. These effects on blood pressure are immediate, after first exercise session, and are sometimes measurable even 12 hours later.[4]

It is well documented that blood pressure reduction with medication

significantly reduces cardiovascular risk. But non-pharmacologic strategies for blood pressure reduction, including weight loss, dietary modification, and exercise, are also effective. Particularly when patients have mild to moderate hypertension, these strategies offer the possibility of reducing blood pressure and cardiovascular risk without any of the adverse side effects associated with medication.[17]

Of course, the effect of daily exercise on hypertension adds up. If patient exercises moderately every day, by the time pressure starts resuming its usual level again. Within four weeks, regular aerobic exercise can lower blood pressure readings by as much as 5-15 mmHg.[4] Therefore, this study was done to examine the effect of aerobic regular exercise training on blood pressure control for patients with mild to moderate hypertension.

As a member of health care team the nurse is vitally concerned about hypertension. Early case finding is one of the roles of the nurse, the nurse should encourage patients to adhere to treatment regimen, monitoring blood pressure as well as lifestyle modification in order to facilitate long term control of hypertension

AIM OF THE STUDY

This study aimed at assessing the effects of a graded walking exercise program on reducing the blood pressure for hypertensive patients.

MATERIAL AND METHOD

Setting:

The study was carried out in hypertension out patient's clinics at the Main University Hospital.

Subjects:

The study sample was including 40 adult patients with mild to moderate hypertension; age ranged from 30-60

years old. They receive antihypertensive drug since one year or more. Exclusion criteria included patients with diabetes mellitus, cerebrovascular disease, significant valvular disease, chronic obstructive lung disease, and history of heart failure, also patients receiving drugs that can raise blood pressure. The exclusion based on patients' history and physical examination by medical doctor. Subjects were divided into two equal groups namely 20 patients as experimental group (GI) and 20 control group (GII).

Tools:

The tools of the study were including the

following:

1- **Patient's** screening sheet

This sheet comprised of two parts of assessment:

Part I demographic data and history

It included patients' name, age, sex, level of education, socio-economic, and marital status as well as the patients' compliance to their therapeutic regimen as following: duration of drugs intake, drugs used, and their usual diet intake.

Part II Follow-up parameters' assessment sheet

This part included follow-up parameters as the patients' condition on

walking exercises program such as:

-Patients' weight (wt.).

-Basal Metabolic index (BMI).

-Heart rate (HR).

-Systolic Blood Pressure (SBP).

-And Diastolic Blood Pressure (DBP).

2- Exercise Guide Sheet for the Patients' Walking Program (EGSPWP)

This sheet comprised the time table for walking program per week and comfort during each walking session.

METHOD

1- A written approval was obtained from the head of the assigned Medical Out Patient Department.

2- Study tools were developed based on thorough review of literature and researches in this field.

3. The informed consent was taken from patients who are eligible for the criteria after explanation of the study purpose.

4. Echo was done for all subjects in experimental group to exclude any patient who suffered from left ventricular hypertrophy.

5. All subjects are met five times, on the 1st time demographic data were taken & after that the height, body weight, heart rate, as well as systolic and diastolic blood pressure were measured to establish baseline data for subsequent evaluation

6. As regard control group, the researchers asked the patients to follow up on 2nd, 4th, 6th, and 8th weeks. In each time, patients' assessment parameter was measured.

As regard the walking program for the experimental group, in the 1st time the researchers asked the patients to walk 3 times a week for 10 minutes for next two weeks and follow-up outpatient clinic & in the 2nd time, the patients were asked to walk 3 times a week for 20 minutes for another next two weeks and follow-up outpatient clinic. The duration of walking exercise increased until it reached 40 minutes in the 4th time follow-up.

7. In each time of follow-up, patients' assessment parameter was measured. Patients were instructed to walk the recommended time without stopping walk except in case if she/he felt dizziness, dyspnea, chest pain, or pain in her/his neck, arm, or shoulder during walking.

8. The researchers asked each subject in

GI as regard their comfort about the duration which was spent on the exercises as means to assess their tolerance and condition with the limited duration and frequency.

Statistical analysis:

Data were analyzed using SPSS with chi-square used in qualitative data and student's t-test in analyzing quantitative data. The correlation between different parameters was done using Pearson's coefficient.

RESULTS

Table 1 showed that mean age of patients in the experimental group (GI) was 48.60±8.45 years while it was 49.25±9.68 years for those in the control group. Approximately all the studied sample of both groups (G1 & G2) were female (95% and 100%), respectively (p value=0.3112). Ninety percent (90%) of patients in the control group (GII) and 80% in the experimental group (GI) were illiterate and minority of both groups of GI & GII can read and write (10% and 20%), respectively. (P value = 0.5175). Low socioeconomic status showed the highest frequency in the experimental and control groups (100% and 95%), respectively. (P = 0.3112). More than three quarters of the studied sample of both groups were married (80%) p value = 1.000.

Table 2 revealed that mean of duration of drugs intake in the experimental group was 4.39±2.89 while, it was 7.53±7.65 for control group (GII). On the other hand, the category of drugs used by both groups of experimental and control groups, was single drug used by 75% and 40% respectively. But combined drug was taken by 25% and 60%, respectively so that, there was a significant difference t = 5.0, p value = 0.01. Seventy percent

of both experimental and control groups were following the lower dietary salt. In relation to the lower dietary fat, the same percent (70%) of experimental group were following it and 60% of control group (t = 0.0, p value = 1.000 and t = 0.4395, p value = 0.5073), respectively.

Table 3 represented the differences between experimental and control groups regarding an effect of walking program on the follow-up parameters namely: weight, basal metabolic index, heart rate, and systolic and diastolic blood pressure, by comparing the 1st time as a baseline data with 2nd, 4th, 6th, and 8th weeks.

Findings revealed that the mean difference between the experimental and control groups was almost similar before the beginning of walking program exercises (baseline data) in relation to all the follow-up parameters namely Wt, BMI, HR, SBP, and DBP (p value = 0.932, 0.671, 0.090, 0.767, and 0.849), respectively.

There was no statistical significant difference between GI and GII as regard weight, and BMI on 2nd, 4th, 6th, and 8th weeks compared with 1st time as baseline data (p value = 0981, 0.758, 0.565, and 0.434), (p value = 0.621, 0.848, 0.927, and 0.756), and (p value = 0.621, 0.848, and 0.927), respectively. It was found that there were slightly effects of exercise on BMI and body weight for the experimental groups. The inversely significant improvement between GI and GII was found only on 2nd week in heart rate as short term effects through walking exercises. (t = 2.03, p = 0.052).

Comparing between group I and group II regarding the benefits of walking program exercises on HR, SBP, and DBP, it was found that there was a statistical significant difference

on 4th, 6th, and 8th weeks in relation to heart rate (p value = 0.00, 0.005, and 0.00), respectively, systolic blood pressure (p value = 0.00, 0.006, and 0.00), respectively, and diastolic blood pressure (p value = 0.009, 0.024, and 0.002), respectively.

Table 4 presents the patient's comfort as regard the duration spent on each walking session by group I. As regard the patient's comfort, it was found that 10%, 20%, and 25% of studied subjects reported that they had discomfort during walking program at 20, 30, and 40 minutes, respectively. In relation to the degree of comfort this table also showed that the majority of the studied subjects 90%, 80%, and 75% reported that they were comfort during 20, 30, and 40 min walking program, respectively.

DISCUSSION

Regular aerobic exercise is one of the most important steps for preventing and controlling high blood pressure.[18]

For patients whose hypertension is shown, over several weeks, to be mild to moderate (pressures less than 160/105 mm Hg), physicians usually suggest a 3-month trial of lifestyle modification before initiating drug therapy. This trial includes, in addition to the exercise prescription, a diet low in salt, alcohol, and calories. Also, patients who smoke should be strongly urged to quit.[17]

As regards to exercise, unfortunately, exercise is not a common practice in Egyptian society although the beneficial aerobic regular exercise training on blood pressure control.

Regarding sex, an earlier meta-analysis of 25 clinical trails looked more closely at patient variables and found that both men and women benefited from aerobic exercise program, with the effect significantly greater in women than in

men.[19] This finding is not observed in the present study as a result of the small number of male patients in relation to female patients.

The present study found a significant reduction of systolic and diastolic blood pressure in 4th, 6th, and 8th weeks (i.e., 2 months). This is in accordance with Hagberg[19] who stated that blood pressure reductions typically appeared within 3 months of the start of training, & further reduction did not occur after that. However, this was not in agreement with Montain *et al*.,[20] who found that improvements in systolic & diastolic blood pressure in first 3 months of exercise training increased further with additional 6 months of exercise training. Generally, when exercise was discontinued, blood pressure rose again.

Regarding duration of exercise, many researchers recommended that duration of exercise should be at least 30 minutes per day; this can be achieved in one continuous session, or, a sum total of smaller periods of exercise throughout the day[6]. This recommendation supported our study. However, some researchers stated that cardiovascular exercise should be performed aerobic exercise for 30 -60 minutes, at least three times a week. Patient may divide his/her session into three 10 minute stretches.[21]

In relation to frequency of walking exercise per week, the present findings showed that walking three times a week produced significant reduction of blood pressure. This was in accordance with the finding of Georgiades, *et al*.,[22] and Franklin & Wappes[23] who found that aerobic exercise performed 3 times a week was enough to reduce a systolic & diastolic blood pressure. However[22,23], this was not in agreement with Halbert JA *et al.,*[12] who stated that a frequency of

three exercise sessions per week has been considered to be the minimal frequency for blood pressure reduction & each subject should participate in a minimum of 30 minutes at least 5 days a week

In the current study, the significant improvement for both systolic and diastolic blood pressure were observed in the experimental group (GI) who was on walking exercise program and followed the prescribed drugs. This result was not in agreement with Niedfeldt and Click *et al*.,[24,25] who revealed that some antihypertensive drugs can impair the ability to exercise or alter the body's response to exercise.

The sad fact is that most physicians don't have discussed the benefits of aerobic exercise with their patients.[26] Managed care limits the amount of time physicians spend with each patient and, often, it's just easier to write a prescription and toss the patient a handout on "Managing Hypertension" or "Managing Cholesterol" or the like.[2]

Aerobic exercise is associated with a significant reduction of blood pressure in hypertensive and normotensive participants and in overweight, as well as normal-weight participants.[18]

It was found that there was a statistical significant difference between group I and group II regarding the benefits of walking program exercises on SBP and DBP, on 4^{th}, 6^{th}, and 8^{th} weeks in relation to systolic and diastolic blood pressure (p value = 0.009, 0.024, and 0.002), respectively. This was in agreement with Whelton *et al*.,[18] & Hagberg[19] who reported that aerobic exercises lowered BP of hypertensive patients. The average drop in blood pressure was 3.9/2.6 mmHg.[18,27,28]

The scientific rationale for exercise

in hypertension is largely built on population studies. Cross-sectional studies have been shown that blood pressure to be significantly lower in active individuals than in their sedentary peers. In one survey of 1,700 men, those who had the least estimated energy expenditure had the highest mean blood pressure, while the most active men had the lowest mean.[17,29] This result is in agreement with our study, which showed that blood pressure was significantly lower in group I (active subjects) than in group II (sedentary subjects).

In the present study, the experimental group of subjects was asked to monitor their comfort during each walking session. It was observed that the minority of the studied subjects feel some discomfort during walking, because walking exercise is not a common practice among Egyptian people and is considered as a new life style. This findings was supported by Hillman and Kravit.[4] they found that chronic adaptations are derived from the accumulation of several continuous exercise bouts over a period of time.

At the end of the study, aerobic exercise program lowered both systolic and diastolic BP. Also the type of aerobic exercise is largely a matter of patient preference. Walking at a 15-minutes/mile pace is ideal for many—it requires no equipment or special clothing and fits readily into most patients' schedules. Some prefer jogging, biking, or swimming. Exercise machines such as treadmills, stationary cycles, or cross-country ski devices provide an effective workout for individuals who enjoy exercising at home, at a health club, or gym

CONCLUSION

The results of the study strongly

support the beneficial effect of aerobic regular exercise in reducting both of systolic & diastolic blood pressure and heart rate in hypertensive patients. It is interesting that the effects of a graded walking exercise program on hypertension add up. If patient exercises moderately three times a week, within four weeks, regular aerobic exercise can lower blood pressure readings and by the time pressure starts resuming its target level.

RECOMMENDATIONS

Special attention should be paid to aerobic exercise for hypertensive patients and should be integral component of hypertension education program.

Booklets with simple instructions and diagrams about aerobic exercise as regard benefits, types, duration, and frequency can be used as a teaching aids for hypertensive patients in all outpatient clinics.

Educational campaign emphasizing the benefits of aerobic exercise in reduction of both systolic and diastolic blood pressure.

Further study to identify the effect of duration and frequency of aerobic exercise program in hypertensive patients.

Table 1: Characteristics of the studied sample

	GI		GII		Sign. Test
	No.	%	No.	%	χ^2 = 1.026 P =(0.3112)
Sex					
Male	1	5	0	0.0	
Female	19	95	20	100	
Age					
Min- Max	30- 60		34- 66		t=0.23
Mean + SD	48.60 ± 8.45		49.25± 9.68		p= (0.822)
Education					
Illiterate	16	80	18	90	χ^2 = 1.318 p=(0.5175)
Read & write	4	20	2	10	
Socio-economic status					
Low	20	100	19	95	χ^2= 1.026 p=(3112)
Moderate	0	0	1	5	
Marital status					
Married	16	80	16	80	χ^2= 0.000 p=(1.000)
Widowed	4	20	4	20	

* Significant P< 0.05
GI: Experimental group
GII: Control group

Table 2: The studied sample compliance to their therapeutic regimen

	GI		**GII**		**Sign. Test**
	No.	%	No.	%	t=1.71 p=(0.095)
Duration of drug intake					
Min – Max (year)	0.80-12		1- 20		
Mean±SD	4.39±2.89		7.53±7.65		
Drugs used					
Single drug	15	75	8	40	χ^2 = 5.01* p= (0.01)
Combination	5	25	12	60	
Lower dietary salt					
Yes	14	70	14	70	χ^2 = 0.0 p= (1.000)
No	6	30	6	30	
Lower dietary fat					
Yes	14	70	12	60	χ^2 =0.4395 p= (0.5073)
No	6	30	8	40	
Echo findings					
Normal	7	35	6	30	χ^2=0.11396 p=(0.736)
Abnormal	13	65	14	70	

* Significant P< 0.05

Table 3: Differences between experimental group and control group for follow up parameters' assessment before and after walking program exercises

Variables	Base line	2nd Week	4th Week	6th Week	8th Week
Weight					
Group I	79.45±9.45	80.03±9.51	79.28±9.69	78.65±9.63	78.15±9.68
Group II	79.72±10.63	80.10±10.56	80.27±10.67	80.53±10.74	80.70±10.68
Test (t)	**0.09**	**0.02**	**0.31**	**0.58**	**0.97**
P	**0.932**	**0.981**	**0.758**	**0.656**	**0.434**
BMI					
Group I	31.56±4.41	31.79±4.45	31.50±4.51	31.25±4.45	31.05±4.48
Group II	31.05±3.10	31.19±3.04	31.26±3.08	31.36±3.10	31.43±3.10
Test (t)	**0.43**	**0.50**	**0.19**	**-0.09**	**-.031**
P	**0.671**	**0.621**	**0.848**	**0.927**	**0.756**
HR					
Group I	83.45±5.65	80.75±3.67	79.65±2.43	79.50±2.91	79.10±2.05
Group II	88.00±10.25	84.50±7.41	87.20±7.80	86.20±9.53	90.40±11.25
Test (t)	**-1.74**	**-2.03**	**-4.13***	**-3.01***	**-4.42***
P	**0.090**	**0.052**	**0.00**	**0.005**	**0.00**
SBP					
Group I	155.25±12.08	149.75±11.29	140.75±7.66	136.00±6.20	127.50±6.39
Group II	154.00±14.29	145.50±12.76	154.50±13.95	146.00±13.92	151.50±13.09
Test (t)	**0.30**	**1.12**	**-3.87***	**-2.94***	**-7.37***
P	**0.767**	**0.272**	**0.000**	**0.006**	**0.00**
DBP					
Group I	91.00±8.37	90.50±7.24	88.00±5.94	84.50±8.26	81.50±6.71
Group II	91.50±8.13	88.25±8.78	93.50±6.71	90.00±6.49	89.50±8.26
Test (t)	**-0.19**	**0.88**	**-2.75***	**-2.34***	**-3.36***
P	**0.849**	**0.382**	**0.009**	**0.024**	**0.002**

* Significant P< 0.05
DBP: Diastolic blood pressure
BMI: Basal metabolic index
HR: heart rate
SBP: systolic blood pressure

Table 4: The patient's comfort as regard the duration spent on each walking session by group I.

Patient's comfort	10 min		20 min		30 min		40 min	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Comfort	20	100	18	90	16	80	12	75
Discomfort	0	0	2	10	4	20	5	25

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