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THE EFFECT OF DASH DIET AND AEROBIC EXERCISES ON CARDIOVASCULAR RISKS IN POSTMENOPAUSAL WOMEN.

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ABSTRACT: This study was designed to investigate the effect of DASH diet and aerobic exercises on cardiovascular risks in postmenopausal women. Forty obese postmenopausal women participated in this study. They were selected randomly from the outpatient clinic of New Cairo General Hospital in Cairo. Their ages were ranged from 50 to 60 years old and their body mass index was 30-35 kg/m². They were divided into two equal groups; group A (Control group) consisted of 20 women treated by antihypertensive medication only (angiotensin-converting enzyme inhibitors) once daily for 3 months, group B (Study group) consisted of 20 women treated by the same medication as in group A in addition to DASH diet and aerobic exercise in the form of walking on electronic treadmill with moderate intensity for 30min.,3days/week for 3 months. BMI was assessed by using standard weight-height scale, Blood pressure (BP) measurement was assessed by sphygmomanometer and lipid profile test was assessed by blood analysis for all women in both groups (A, B) before and after treatment. Results of this study found that, there was a statistically significant difference in systolic and diastolic BP, High density lipoprotein(HDL), Low density lipoprotein(LDL), cholesterol and triglycerides(TG) at post treatment in compare to pre-treatment (P value = 0. 001) in both groups A and B. Between groups, there was no statistical significant difference in systolic and diastolic BP, HDL, LDL, cholesterol and TG pretreatment, but there was a statistically significant difference in systolic and diastolic BP, HDL, LDL, cholesterol and TG post treatment (favoring group B). Accordingly, it could be concluded that DASH diet in addition to aerobic exercises had significant effect in lowering both systolic and diastolic BP and improving lipid profile and could be included in the intervention program of hypertensive postmenopausal women.

KEY WORDS: Aerobic exercise, DASH diet, cardiovascular risks, Menopause.

I. INTRODUCTION

Cardiovascular diseases (CVDs) have become one of the leading causes of deaths worldwide especially among low income countries. CVDs are a diverse class of diseases that include coronary heart diseases, hypertension, Ischemic heart disease (IHD), stroke and heart failure etc. The major risk factors associated with CVDs are dyslipidemia, inflammation, oxidative stress and tobacco, sedentary lifestyle and changing food habits which result in low consumption of fruits and vegetables and is regarded as a significant factor for widespread prevalence of CVDs [**1].**

Menopause is a physiological process usually signifies the end of a woman's reproductive life. A twelve-month period of amenorrhea confirms that menopause has set in. It is an estrogenic deficiency period associated with a wide variety of physical and psychological symptoms **[2].**

Rates of hypertension increase after menopause when estrogen levels fall. This suggests estrogen may have a vascular protective effect in premenopausal women. Estrogen reduces oxidative stress via lower reactive oxygen species generation and increased antioxidant production and also reduces infammation via inhibition of profibrotic genes and stimulation of neoangiogenesis. Therefore, lower estrogen levels after menopause may partially explain lower arterial compliance, increased risk of hypertension **[3]**and several lipid metabolism disorders **[4]; (**hypertriglyceridemia, low HDL-c and a predominance of small dense LDL particles), like the abnormalities seen in the metabolic syndrome. This lipid profile is found in 15–25% of postmenopausal women and might in part be responsible for their increased cardiovascular risk **[5].** The new guidelines emphasize prevention, detection, evaluation, and management of hypertension to reduce the CVD risk factors **[6].**

The dietary approaches to stop hypertension (DASH) which emphasizes fruit, vegetables, fat-free/low-fat dairy, whole grains, nuts and legumes, and limits total and saturated fat, cholesterol, red and processed meats,

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sweets, added sugars, and sugar-sweetened beverages, was originally developed through research sponsored by the US National Institutes of Health (NIH) to treat hypertension without medication and successfully demonstrated a clinically meaningful blood pressure lowering effect **[7].**

The DASH diet is high in some of bioactive compounds (e.g., fiber, minerals, trace elements, vitamins, and phytochemicals)and is found in whole grains, fruits, and vegetables that have antioxidant, anti-atherogenic, anti-inflammatory, antiproliferative, and anti-tumor properties. These compounds are inversely associated with the risk of cancers, CVD, and other chronic diseases [**8].**

Diuretics, β-blockers, Calcium channel blockers and angiotensin-converting enzyme inhibitors (ACE) are suggested as first-line drugs in uncomplicated hypertension **[9]** Comorbidities in women may influence the choice of antihypertensive treatment. Women may also experience more antihypertensive medication side effects than men that may impact choice of treatment and adherence **[10].**

Physical activity has been shown to improve body composition (e.g., through reduced abdominal adiposity and improved weight control), enhance lipoprotein profiles including reduced triglyceride levels, increased high-density lipoprotein (HDL) cholesterol levels and lower the ratio of low density lipoprotein (LDL) to HDL ,improve glucose homeostasis and insulin sensitivity, reduce blood pressure, reduce systemic inflammation, decrease blood coagulation, improve coronary blood flow, and enhance endothelial function. All factors that play a major role in CVD **[11].**

II.SUBJECTS, MATERIALS AND METHODS

1-Subjects:

Forty obese hypertensive postmenopausal women participated in this study. They were selected randomly from the outpatient clinic of New Cairo General Hospital in Cairo. The study was conducted from August 2019 to March 2020. Their ages were ranged from 50 to 60 years old and their body mass index was 30-35 kg/m². They were first diagnosed as hypertensive in their early postmenopausal period, their blood pressure ranged from 140/90mmHg to <160/100mmHg. Women with cardio-pulmonary diseases, diabetes mellitus, malignancy, surgical menopause, mental disorders, and life threatening disorders as renal failure were excluded from the study. Design of the study was two groups pre-test post-test experimental design. They were divided randomly into two equal groups; group A (Control group) consisted of 20 women treated by antihypertensive medication only (angiotensin-converting enzyme inhibitors) once daily for 3 months, group B (Study group) consisted of 20 women treated by DASH diet and aerobic exercises in the form of walking on electronic treadmill with moderate intensity (60 to 75% of maximum heart rate) for 30 min., 3 days/week for 3 months in addition to the same medication as in group (A).

2- Materials

1- **Informed consent form.**

2- **Weight-height scale:** It was used to measure the body weight and height to calculate the BMI for both groups A and B before and after treatment.

3- **Mercury sphygmomanometer and stethoscope**: It was used to measure systolic and diastolic blood pressure for both groups A and B before and after treatment.

4- **Test tubes, Syringes, cotton and alcohol:** were used to collect blood samples to measure lipid profiles for patients in both groups A and B before and after treatment.

5- **DASH diet plan:** It was followed by patients in group (B).

6- **Electronic treadmill: (DX12-DKB, China):** It was used for exercise program by patients in group B for 30 min., 3 days/week for 3 months.

3- Procedures

All women were given a full explanation of the protocol of the study and consent form was signed for each woman before participating in the study.

Evaluative procedures

A detailed medical history and physical examination were taken from each woman in both groups before starting the study.

1- Body mass index (BMI):

Weight and height were measured to detect the BMI according to the following equation: BMI= weight/height² (Kg/m²), before treatment for both groups (A and B).

2- Blood pressure measurement:

A mercury sphygmomanometer was used to measure blood pressure before and after treatment for all patients in both groups A and B: the patient was seated on a chair for 5 min with her back supported, and wrist relaxed at heart level the rubber cuff of the sphygmomanometer was wrapped around the left upper arm of the participant and a stethoscope was placed over the brachial artery. The rubber cuff was inflated with the air to constrict arteries. As the air in the cuff was released, the first sound heard through the stethoscope marked the systolic pressure, the point where the sound disappeared marked the diastolic pressure. These procedures were performed two times and the average of BP was taken.

3- Lipid profile assessment:

The lipid profile test It was done for all patients in both groups A and B before and after treatment. A

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sample of 3ml of venous blood was drawn from all patients after following overnight fasting (12 hours fasting) at 9.00 am via vein puncture of an antecubital vein in the forearm. Serum blood withdrawn from the syringe was poured into the test tube and then the blood was left for a period ranged from 10 to 20 minutes at room temperature. After full coagulation of the blood sample, it was placed in a centrifuge device and the results of the test were taken and computerized to make a report.

Treatment procedures:

a) DASH Diet protocol:

All Patients in group (B) received counselling on the DASH diet and were provided feedback on their adherence to the diet in weekly 30- to 45-minute small group sessions for 3 months. The individualised DASH diet goals were recommended with respect to high consumption of fruits (4–5 serves/ day) and vegetables (4–5 serves/day), low-fat dairy products (2–3 serves/day), lean meats, poultry, and fish (≤6 serves/day), and nuts, seeds, and legumes (4–5 serves/ week**)**. The goals also included the achievement of limited intake of sweets, added sugars (≤5 serves/week), and fats and oils (2–3 serves/day) maximum amount of total fat ≤27% of energy, saturated fatty acids (SFA) ≤7% of total fat and maximum sodium intake of 2300 mg per day **[12].**

It includes: a variety of vegetables from all of the subgroups: dark green, red and orange, legumes (beans and peas), starchy, and other. Fruits; especially whole fruits. Grains; at least half of which are whole grains. Fat-free or low-fat dairy, including milk, yogurt, cheese, and fortified soy beverages. A variety of protein foods, including seafood, lean meats and poultry, eggs, nuts, seeds, and soy products.

b) Exercise Program:

All patients in group (B) received a program of aerobic exercise in the form of walking on the treadmill for 30 minutes through 3 phases: Warming up phase: included walking on the treadmill for 5 min with light intensity 40% of Maximum Heart Rate (MHR), Actual phase: included walking on the treadmill for 20 min with moderate intensity 60-75% of MHR and Cooling phase: included walking on the treadmill for 5 minutes with light intensity 40% of MHR. MHR was calculated according to (210-Age). The frequency of exercise was 3 times per weeks for 3 months **[13].**

III. STATISTICAL ANALYSIS

Results are expressed as mean ± standard deviation. Test of normality, Kolmogorov-Smirnov test, was used to measure the distribution of data measured at pre-treatment. Accordingly, comparison between normally distributed variables in the two groups was performed using unpaired t test. Analysis of covariance (ANCOVA) test was used to compare the pre-treatment values of the two groups and on the same time between post-treatment values on controlling the effect of pre-treatment value. Comparison between pre- and post-treatment data in the same group was performed using paired t test. Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. P value ≤ 0.05 was considered significant.

IV. RESULTS

1- General characteristics of the patients:

There was no significant difference ($p>0.05$) in the mean value of age, weight, height and BMI between both groups A and B before treatment. (Table 1)

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Table 1: Physical characteristics of patients.

	Group A (n= 20)	Group B (n= 20)	t value	P value
Age (yrs.)	56.45 ± 2.06	55.30 ± 2.45	1.605	0.117 (NS)
Weight (kg.)	86.45 ± 6.31	85.50 ± 7.09	0.448	0.657 (NS)
Height (cm)	163.45 ± 5.22	162.80 ± 5.62	0.379	0.707 (NS)
BMI (kg/m2)	32.33 ± 1.36	32.16 ± 1.26	0.399	0.692 (NS)

Data are expressed as mean ± SD or number (%). NS= p> 0.05= not significant.

2- Measurement of Blood pressure:

Systolic blood pressure(SBP) and Diastolic blood pressure(DBP)

A- Within groups:

There was a statistical significant decrease in the mean value of SBP and DBP measured at post-treatment when compared with its corresponding value measured at pre-treatment in both groups A and B (p= 0.001).

B- Between groups:

Between groups A and B, at pre-treatment, there was no statistical significant difference. ANCOVA test was used to compare the post-treatment values of the two groups on controlling the effect of pre-treatment value. The results of SBP and DBP revealed that there was a statistical significant decrease in their levels in group B when compared to their corresponding level in group A (Table 2 ,3).

Table 2: Intra and inter-group comparison between mean values of SBP in groups A and B.

	Group A (n= 20)	Group B (n=20)	F value	P value
Pre-treatment	149.00 ± 6.41	150.00 ± 6.28	0.248	0.621 (NS)
Post-treatment	143.25 ± 5.68	135.25 ± 5.25	70.167	0.001 (S)
Mean difference	5.75	14.75		
% change	3.86 ↓↓	9.83 ↓↓		
t value	10.510	13.968		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS=p>**0.**05= not significant S= p≤ 0.05= significant.

Table 3: Intra and inter-group comparison between mean values of DBP in groups A and B.

	Group A (n= 20)	Group B (n= 20)	F value	P value
Pre-treatment	93.00 ± 3.40	93.75 ± 4.25	0.379	0.542 (NS)
Post-treatment	89.00 ± 3.48	81.00 ± 4.17	72.399	0.001 (S)
Mean difference	4.00	12.75		
% change	4.30 ↓↓	13.60 ↓↓		
t value	6.839	13.813		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS= p> **0.**05= not significant S= p≤ 0.05= significant.

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3- Lipid profile test:

High density lipoprotein (HDL), Low density lipoprotein (LDL), Cholesterol and Triglycerides (TG):

A- Within groups:

There was a statistical significant difference in the mean value of HDL, LDL, cholesterol and TG measured at post-treatment when compared with its corresponding values measured at pre-treatment in both groups A and B (p 0.001).

B- Between groups:

Between groups A and B, at pre-treatment, there was no statistical significant difference. ANCOVA test was used to compare the post-treatment values of the two groups on controlling the effect of pre-treatment value. The results of HDL, LDL, cholesterol and TG revealed that there was a statistical significant difference in their levels in group B when compared to their corresponding levels in group A (Table 4, 5,6,7).

Table 4: Intra and inter-group comparison between mean values of HDL in groups A and B.

	Group A (n= 20)	**Group B (n= 20)**	**F value**	**P value**
Pre-treatment	45.65 ± 6.04	46.00 ± 6.89	0.029	0.865 (NS)
Post-treatment	47.50 ± 6.58	54.50 ± 6.20	23.760	0.001 (S)
Mean difference	1.85	8.50		
% change	4.05 ↑↑	18.48 ↑↑		
t value	-3.285	-6.240		
p value	0.004 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS= p> 0.05= not significant S= p≤ 0.05= significant**.**

Table 5: Intra and inter-group comparison between mean values of LDL in groups A and B.

	Group A (n= 20)	**Group B (n= 20)**	**F value**	**P value**
Pre-treatment	166.60 ± 30.86	171.75 ± 28.26	0.303	0.585 (NS)
Post-treatment	154.60 ± 35.81	125.55 ± 29.05	28.105	0.001 (S)
Mean difference	12.00	46.20		
% change	7.20 ↓↓	26.90 ↓↓		
t value	4.695	7.982		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS= p> **0.**05= not significant S= p≤ 0.05= significant.

Table 6: Intra and inter-group comparison between mean values of cholesterol in groups A and B.

	Group A (n= 20)	**Group B (n= 20)**	**F value**	**P value**
Pre-treatment	281.80 ± 26.72	264.95 ± 34.90	2.939	0.095 (NS)
Post-treatment	273.30 ± 29.28	211.50 ± 31.78	106.542	0.001 (S)
Mean difference	8.50	53.45		
% change	3.02 ↓↓	20.17 ↓↓		
t value	7.021	12.368		
p value	0.090 (NS)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS= p> **0.**05= not significant S= p≤ 0.05= significant.

Table (7): Intra and inter-group comparison between mean values of TG in groups A and B.

	Group A (n= 20)	**Group B (n= 20)**	**F value**	**P value**
Pre-treatment	244.80 ± 39.05	240.70 ± 39.80	0.108	0.744 (NS)
Post-treatment	241.10 ± 38.28	197.30 ± 34.54	94.293	0.001 (S)
Mean difference	3.70	43.40		
% change	1.51 ↓↓	18.03 ↓↓		
t value	4.056	10.037		
p value	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. t value= paired t test. NS= p> **0.**05= not significant S= p≤ 0.05= significant.

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V. DISCUSSION

Cardiovascular disease (CVD) increases dramatically in women at the onset of menopause, by as much as 2–4 times. In addition to increased risk for CVD, women at menopause are also at a greater risk for high LDL cholesterol levels, hypertension, diabetes, and obesity, which further elevates cardiovascular risk factors in both perimenopausal and postmenopausal women [**14].**

The DASH diet, rich in fruits, vegetables, whole grains, and low-fat dairies, thus having a beneficial content of nutrients implicated in blood pressure pathophysiology, is currently recommended for the prevention and management of hypertension in adults **[16]**

Regular exercise is a very effective method to improve both physical and mental health in postmenopausal women. There are numerous advantages of exercise, including ameliorations in the serum lipid levels, weight reduction, and chronic vascular disease avoidance. Women who performed exercise routinely recorded decreased levels of pressure and less menopausal adverse effects. In addition, it positively affects enhancing the body's capacity to utilize insulin, the heart muscle condition, and enhance moderate anxiety and stresses, and BP reduction **[17].**

This study was designed to investigate the effect DASH diet and aerobic exercises on cardiovascular risks in postmenopausal women. Forty obese hypertensive postmenopausal women participated in this study. They were selected from the outpatient clinic of New Cairo General Hospital in Cairo. Their ages were ranged from 50 to 60 years old, their body mass index was 30-35 kg/m² and their blood pressure ranged from 140/90mmHg to <160/100 mmHg.

They were divided randomly into two equal groups; group A (Control group) consisted of 20 women and treated by antihypertensive medication only (angiotensin-converting enzyme inhibitors) once daily for 3 months, group B (Study group) consisted of 20 women treated by the same medication as in group A and in addition to DASH diet aerobic exercise in the form of walking on electronic treadmill with moderate intensity (60 - 75%ofMHR) for 30min.,3days/week for 3 months.

BMI was assessed by using standard weight-height scale, Blood pressure (BP) measurement was assessed by sphygmomanometer and lipid profile test was assessed by blood analysis for all women in both groups (A, B) before and after treatment.

Results of this study found that, there was a statistically significant decrease in systolic BP, diastolic BP, LDL, cholesterol, TG and a statistically significant increase in HDL at post treatment in compare to pre-treatment (P-value < 0. 001*) in both groups A and B.

Between groups A and B, at pre-treatment, there was no statistical significant difference. ANCOVA test was used to compare the post-treatment values of the two groups on controlling the effect of pre-treatment value. The results of HDL, LDL, cholesterol and TG revealed that there was a statistical significant difference in their levels in group B when compared to their corresponding levels in group A.

The significant improvement in blood pressure and blood lipid levels with DASH diet is due to several mechanisms. The diet consists of a lot of fruits and vegetables combined with low fat dairy products with diminished saturated and total fat content and low level of cholesterol with a fair amount of whole grains, nuts, poultry and fish. Usually, red meat, sweets and sugar-containing beverages are exempted from DASH diet and are enriched with potassium, magnesium, calcium and fiber with excess of antioxidants. Such diets have been reported to reduce systolic B.P. by 5.5 mmHg and diastolic BP. by 3mmHg **[18].**

Asghari et al., [19] had proposed many mechanisms for beneficial effects of following a DASH diet on CVDs risk. Greater intakes of fiber especially soluble fiber; folate, vitamin C, and phytochemicals such as flavons, flavonons, carotenoids, and phytoesterol in the DASH diet may result in incensement of antioxidant capacity, may have a blood pressure–lowering effect and a beneficial effect on lipid profile, insulin sensitivity, and reduction in oxidative stress.

Penton et al., [20] stated that a high intake of potassium and magnesium may have antihypertensive effects derived from the ability of both minerals to induce vasodilation, reduce the release of renin at the kidney level, and establish a negative balance with sodium

The results of this study agreed with that of **Chiavaroli et al., [21]** whose systematic review and meta-analysis found that the DASH diet was directly linked to a reduction in systolic BP and diastolic BP as well as to an improved lipid profile, total cholesterol and low-density lipoprotein (LDL) cholesterol.

The results of this study were in line with that of **Damasceno et al., [22]** who confirmed that DASH diet substantially reduced the levels of blood pressure during the first eight weeks of compliance. This reduction reaches 5.5 mmHg in systolic blood pressure (SBP) and 3.0 mm in diastolic blood pressure (DBP) during this period.

The results of this study also agreed with **Rifai et al., [23]** who conducted a randomised, controlled trial comparing DASH to general heart failure (HF) dietary recommendations over 12 weeks in 48 patients with mild to moderate HF. Significant increases in large artery elasticity, exercise capacity and quality of life were reported. All of these changes were achieved without weight loss.

The results of the current study were in agreement with that of **He et al., [24]** who stated that all patients whose BP is greater than optimal (120/ 80 mmHg) could benefit from lower sodium intake.

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Also, the results of the current study were supported by that of **Larsson et al., [25]** whose findings indicated that high adherence DASH diet along with regular physical activity reduced the risk of ischemic stroke.

On the other hand, the results of this study were in contrast with studies of **Del Gobbo et al., [26]** who found no association between adherence to a DASH-style diet and CVD mortality or incidence

Regarding the significant improvement in blood pressure and blood lipid level after performing aerobic exercise could be attributed to several mechanisms as exercise stimulates the production of nitric oxide (NO) by the endothelium. NO enhance smooth muscle relaxation and maintains the blood vessel in the normal resting state, which profoundly impacts vascular resistance. Exercise also appears to increase large artery compliance. Decreases in catecholamine and total peripheral resistance, improved insulin sensitivity, and alterations in vasodilators and vasoconstrictors are some of the postulated explanations for the antihypertensive effects of exercise **[27].**

The results of this study were in line with those of **Ried et al,. [17]** who concluded that regular exercise is a very effective method to improve both physical and mental health in postmenopausal women, including ameliorations in the serum lipid levels, weight reduction, chronic vascular disease avoidance and less menopausal adverse effects. In addition, it positively affects enhancing the body's capacity to utilize insulin, the heart muscle condition,

The results of current study were also in agreement with those reported by **Turky et al. [28]** who investigated the effects of 2 months of doing the moderate form of exercise training on BP and levels of nitric oxide in 30 hypertensive postmenopausal women. BP levels were statistically significantly diminished. The outcomes from this investigation likewise support the fact that physical exercise is a crucial factor to diminish CVDs, as moderate intensity of exercise training builds nitric oxide discharge from the endothelium, which is considered as a vasodilator.

The results of this study also were supported by that of **Márquez -Celedonio et al., [29]** who examined the effect of the DASH- type diet and aerobic physical exercise on subjects who undertook 3-5 sessions per week for 6 months. Each session lasted 45 min. the subjects experienced a reduction in blood pressure.

The results of the current study also were supported by study done by **Ghahramanloo et al. [30]**who reported that concurrent training can be used to simultaneously improve the serum lipid profile and body composition of previously untrained, apparently health young men.

The results of the current study agreed with that of **Trejo-Gutierrez and Fletcher [31]** who concluded that exercise exerted an effect on HDL-C maturation and composition, cholesterol efflux, and cholesterol delivery to receptors (reverse cholesterol transport). Positive effects of exercise were also seen with blood TG, but little specific effect was seen on LDL-C and total cholesterol.

The findings of this research were also confirmed with **Åkesson et al., [32]** who stated that the combination of high-quality diet (the highest quintile of adherence to a diet high in fruits and vegetables, legumes, nuts, reduced-fat dairy products, whole grains, and fish) and physically active lifestyle (at least 40 minutes of walking or biking per day and one hour of additional physical activity per week),was associated with a reduced risk of myocardial infarction compared with those who adopted none of the healthy lifestyle behaviors.

The results of the this study were supported by that of **Paula et al.,[33]** who found in controlled trials that the combination of DASH diet and exercise contribute to a significant decrease in BP compared to DASH alone or exercise alone.

The results of the current study agreed with the results of studies done by **Edwards et al**., **[34]** that examined the relationship between the combination of the DASH diet and exercise and blood pressure; and concluded that the combination of the DASH diet and exercise were associated with blood pressure reduction and the reduced risk of developing cardiovascular disease.

The results of the current study was also supported by that of **Blumenthal et al. [35]** who found that the addition of the DASH diet and exercise to the treatment plan of overweight/obese persons with high blood pressure was associated with greater blood pressure reductions, greater improvements in vascular and autonomic function and reduced ventricular mass.

On the other hand, the results of this study were contradicted with that reported by **Fuchs, [36]** who found low effectiveness of non- drug interventions (DASH) in patients with hypertension and prehypertension because the efficacy of dietary interventions is lost with time.

VI. CONCLUSION

It can be concluded that aerobic exercise and DASH dietary pattern had significant effect in lowering both systolic and diastolic BP and improving lipid profile in postmenopausal women. Accordingly, can be used as preventive methods from developing cardiovascular disease.

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