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Effect of Diet and Walking Exercise on Blood Pressure in Hypertensive Patients

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Abstract: **Dietary Approaches to Stop Hypertension (DASH) has been shown to effectively diminish systolic (SBP) and diastolic blood pressure (DBP). The DASH diet and increased physical activities were associated with clinically significant decreases in blood pressure in hypertensive patients. Objective: to assess the effect of DASH diet and walking exercises on blood pressure in hypertensive patients. Setting: The study was conducted at the cardiology outpatient clinic at the Main University Hospital in Alexandria. Subjects: They comprised a convenience sample of 60 patients with hypertension who were classified into group A (DASH) and group B (DASH and walking exercise) (n=30 in each group). Tools: Tool I: Hypertensive Patients Knowledge, Attitude Structured Questionnaire. Tool II: Blood Pressure Measurement Chart. Tool III: Health Education Module. Results: Patients received diet approach to stop hypertension (DASH) and walking exercises (Group B) exhibited improvement in the blood pressure than patients who received diet approach (DASH) only to stop hypertension (Group A). Conclusion: Using exercises in combination with DASH had a significant effect on reduction of blood pressure in hypertensive patients. Recommendations: The developed booklet about DASH diet and walking exercise should be available and distributed to each hypertensive patients at Cardiology Unit and develop health teaching program to nurses working in Cardiology Unit.**

Keywords: **Walking Exercises, Blood Pressure, Hypertensive Patients, DASH.**

I. INTRODUCTION

Hypertension is a significant public health challenge in both developing and developed nations [(1)]. Its a persistent elevation of the systolic blood pressure(SBP) at a level of 140 mm Hg or more and diastolic blood pressure(DBP) at a level of 90 mm Hg or more based on the average of two or more correct blood pressure measurements taken by healthcare providers.[(2,3)]

Worldwide prevalence estimates for hypertension may be as much as one billion people, and around seven million deaths per year may be attributable to hypertension[(4)].
It is the most widely recognized risk factor for cardiovascular disease, cerebrovascular stroke and end-stage renal failure. Various studies have reported a significant relationship between hypertension and risk factors such as age, BMI, smoking and lack of physical activity.[(5,6)]

Hypertension is classified according to its cause as either primary (essential) hypertension or secondary hypertension. About 90 - 95% of patients are categorized as primary hypertension, defined as high blood pressure with no obvious underlying causes.[(7)] The remaining 5-10% of patients are categorized as secondary hypertension, defined as hypertension due to an recognizable cause, such as drugs side effects, chronic kidney disease, stenosis of the aorta or renal arteries, or an endocrine disorder such as excess cortisol, aldosterone, or catecholamines. [(8-10)]

It is the third largest killer in the world, around 1 in 8 deaths global is due to hypertension.[(11,12)] Also, the Egyptian national hypertension project estimates that the prevalence of hypertension in Egypt is 26.3%. The prevalence of hypertension has increased gradually with age, from nearly eight percent in 25-34 year –olds to sixty percent in those 75 years or older.[(13,14)]

Hypertension is scarcely associated by any symptoms. Patients with hypertension complain headaches (especially at the back of the head and early in the morning), as well as, vertigo, tinnitus (buzzing or hissing in the ears), nosebleed, blurred vision or fainting episodes.[15] These symptoms, however, might be linked to associated anxiety rather than the hypertension itself.[16]

The guidelines eliminate the category of pre-hypertension, classifying patients as having either elevated (120-129 systolic and 80 diastolic mmHg) or Stage I hypertension (130-139 systolic and/or 80-89 diastolic mmHg). While preceding guidelines classified 140/90 mmHg as Stage 1 hypertension, this level is categorized as Stage 2 hypertension under the recent guidelines. In addition, the guidelines emphasize the importance of using correct technique to measure blood pressure; recommend use of home blood pressure monitoring using accurate devices; and highlight the value of suitable training of healthcare providers to disclose "masked hypertension", Hypertensive crisis: Systolic above 180 and/or diastolic above 120, with patients′ requiring rapid changes in drugs if there are no other indications of problems, or immediate hospitalization if there are signs of organ harm.[17]

Research suggested that overweight or obesity, lack of activity, anxiety (psychological tension), and an unhealthy food are associated with hypertension. Although treatment through medication is most common, behavioral methods might also be effective through improving eating and exercise behaviors, reducing anxiety, and lowering weight. [18]

A variety of lifestyle amendments have been shown in clinical trials to reduce blood pressure. These include weight loss in the overweight [19], physical activity [20], a diet with increased fresh fruits and vegetables and reduced saturated fat content [21], and reduction of dietary sodium intake [21,22].

The Dietary Approaches to Stop Hypertension (DASH) – a diet focuses on a high intake of vegetables, fruits, seafood and foods with low levels of fat, salt, dairy products, lean meats, cholesterol, and sugar significantly reduces the levels of blood pressure. [23]

The DASH diet lowered systolic blood pressure(SBP) by an average of about six points and diastolic blood pressure (DBP) by about three points in patients with pre-hypertension (Systolic ≥120mm Hg, diastolic ≥80 mm Hg). Those with hypertension (Systolic above 140mm Hg, diastolic above 90mm Hg) dropped by eleven and six points, respectively. These alterations in blood pressure happened with no changes in body weight. It also reduces bad cholesterol (LDL) and the 10-year hazard of heart attack.[24,25]

The correlation between usual physical activity and the development of hypertension have been found in several studies it was found that physical activity was associated with a significant reduction in mean systolic and diastolic blood pressure 8.75 mmHg and 4.25mmHg, respectively. Patients who exercised 3 times/week.[26] The long-term BP useful health effect of walking has already been demonstrated in patients with hypertension and type 2 diabetes.[27] and more than 10,000 steps per day have been recommended for these patients.[28]

Aim of the study: To assess the effect of the DASH diet and walking exercise on blood pressure measurements among hypertensive patients.

Hypothesis of the study:

- Patients who receive the DASH diet will exhibit improvement in blood pressure than before.
- Patients who receive walking exercise and DASH diet will exhibit improvement in blood pressure than those who receive the DASH only.

II. MATERIAL AND METHODS

Materials

Research design:

A Quasi-experimental research design was utilized for this study.

Setting:

This study was conducted at the Cardiology Unit, Alexandria Main University Hospital. The Outpatient Unit consists of 2 beds for patients' who had hypertension. The out-patient clinic receives patients from 8:00 am through 2:00 pm, 3dyas/ week.

Subjects:

Subjects of the study included a convenience sample of 60 adult hypertensive patients showing up at the Cardiology Outpatient Clinic at the Main University Hospital in Alexandria. The EPI info program was used to estimate sample size using the following parameters:

Population size= 400.

Expected frequency= 50%.

Acceptable error= 5%.

Confidence coefficient= 95.

Minimal sample size= 60.

Inclusion Criteria were:

- Adult patients aged 20-65 years old from both sex.
- Able to communicate.
- Diagnosed with hypertension for a period not less than one year and without any coexisting conditions, requiring limitations of activities or special diets.
- Approving and willing to participate in the study.
- Patients with any physical or mental alterations were excluded.

Every patient was assigned randomly into one of two groups (30 patients in each group). Group (I) received instructions about the DASH diet only while patients in group (II) were received instructions about walking exercise and the DASH diet.

Tools of the study: Three tools were used to collect the necessary data.

Tool I: Hypertensive Patients Knowledge, Attitude Structured Questionnaire

This tool is an Arabic tool developed by (Habib et al., 2016) and adapted by the researchers after reviewing of literature to assess the knowledge and attitude of the hypertension patients about DASH diet. It comprised three parts to collect data concerning; Patient's socio-demographic characteristics, personal health history and lifestyle, and questions to test the knowledge of the patient about the DASH diet. [29-31]

Part I: This part included subjects socio-demographic characteristics including the patient's name, age, sex, marital status, level of education, economic status, religion and occupation.

Part II: Personal health history and lifestyle which cover data about onset and duration of the illness, treatment regimen, regularity of the treatment time, number of blood pressure measurement per week and data about their lifestyle as; daily activity, physical effort, sleeping pattern, unhealthy habits as smoking, alcohol intake, and nutritional habits as amount of tea and coffee received daily, salty and fatty foods, and amount of daily fluids.

Part III: Questions to test the knowledge of the patient about the **DASH diet** and include the following points:

A) General knowledge about DASH, included questions about DASH, significance of having lots of vegetables, fruits, appropriate type of milk products, impact of excess salt and salty foods on blood pressure, the best type of baking, does excess fats and fatty foods affect blood pressure, appropriate type of fats, the best type of oil, effect of exercise on blood pressure and effect of smoking on blood pressure.

B) Knowledge about serving size in DASH, included questions about the suitable serving size of fruits and vegetables, dairy products, meat, poultry, fish, seeds, dry beans, grains, and sweets.

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C) Statement to test the attitude towards DASH, included questions about the following areas as the DASH plan to lower blood pressure, limiting salt intake control blood pressure, having fruits instead of sweets as a dessert, stop smoking and carrying out exercise help to lower blood pressure.

The patients' responses were calculated as follows: The right answer equals 1 score, the wrong answer equals 0. The total knowledge score was 17. A minimum score equals 0. Respondents ' total score will be converted into a percentage. Good knowledge > 65% while, Poor knowledge ≤ 50%.

Scoring of attitude questions:

The patients' attitude responses were rates as follows: Agree equal 1 score, disagree equal 0 score. The same pre-test questionnaire was used as a posttest to assess the knowledge and attitude of both groups (GA) and (GB) after health education sessions.

Tool II: Blood Pressure Measurement Chart.

This chart was developed by the researchers to follow study group subjects A, B blood pressure subjects on a weekly base, for 8 successive weeks.

Variables	Group (A) DASH only								
	Pre health teaching	Post health teaching							
		1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
• Systolic blood pressure									
• Diastolic blood pressure.									
Variables	**Group (B) DASH and Walking exercise**								
	Pre health teaching	**Post health teaching**							
		1st Week	**2nd Week**	**3rd Week**	**4th Week**	**5th Week**	**6th Week**	**7th Week**	**8th Week**
• **Systolic blood pressure**									
• **Diastolic blood pressure.**									

Tool III: Health Education Module.

The hypertensive patients included in the group (A) were given educational sessions to improve their knowledge and attitude towards the DASH diet this module contents were based on the definition of DASH, importance of the DASH diet, DASH eating plan and other lifestyle modifications needed to control hypertension. The educational instruction was conducted by the researcher through personal interviews in health education sessions. Each session took about 30-45 minutes and was held 3 times weekly in the cardiology outpatient clinic. The teaching was facilitated by the use of posters and booklets which contain the most important items in health education. Group (B) subjects received educational instructions about DASH and walking exercise.

Methods:

– Written permissions to conduct the study were obtained from the Ethical Committee at the Faculty of Nursing at Alexandria University.

– An official letter from the Faculty of Nursing was submitted to the general administrated directors of Alexandria Main University Hospital as well as to the Cardiology Outpatient Unit at the Alexandria Main University Hospital for obtaining permission to carry out the study after explanation of the study aim.

– Tools (I, II and III) were developed by the researchers after reviewing current related literature[29-31].

– The study tools were revised by two experts in the field of cardiology and three experts in Medical-Surgical Nursing, to test the tools for content validity, completeness, and clarity of the items. Accordingly, the necessary modifications were carried out.

– The reliability of the tools was tested using Cronbach's Alpha where r=0.80.

– A pilot study was conducted on a sample of 10% of patients prior to the actual data collection, to test the clarity, feasibility of the tools and to identify the obstacles that may be faced during data collection. Pilot subjects were excluded from the study sample.

– Data collection: Data were collected during a period of 6 months from January 2019 to June 2019. The study was carried out through four phases: assessment, planning, implementation, and evaluation.

I- Assessment phase: During this phase, an exploratory visit was carried out to the Cardiology Outpatients Clinic in order to estimate the rate of admissions and suitable time for data collection. Various personal communications were done with staff nurses and physicians to explain the purpose of the study and gain their best possible cooperation. Patients who met the study criteria were included in the study after explaining the nature and purpose of the study and obtaining their consent.

The study subjects meeting the inclusion criteria were assigned and divided into two equal groups.

Group A: Patients in this group received instructions in modifying the content of their diet to meet DASH guidelines. They were asked not to exercise or to try to lose weight and to focus their attention only on what they eat and received instruction on the DASH diet and were provided feedback on their commitment to the diet. Also, patients were learned how to select their food. **Group B:** Patients in group B received instructions about DASH and walking exercise. Patients had performed walking exercise 3 times per week. The walking exercise routine consisted of ten minutes of warm-up exercises, thirty minutes of walking and six minutes of cool-down exercise.

Initial assessment was carried out for every patient in the study groups individually at the outpatient clinic before measuring blood pressure to assess their knowledge and attitude about the DASH diet using the tool I and II. This initial assessment took 30-45 minutes.

II- Planning Phase :

Based on the results of the assessment phase and the review of related literature, health teaching was developed, the objective of the module was established to enhance subjects′ attitude and knowledge about the DASH diet for group (A) and walking exercise and DASH diet for group (B).

Blood pressure was measured using blood pressure measurement chart before the educational sessions and every one week for both groups till eight weeks (2 months). The blood pressure was measured by using mercury sphygmomanometer. The BP was measured while patients were in a seated position with flexed arm, the flexed elbow should be at the level of the heart and sustained and if the patient is anxious, taking the pressure was post ponded for few minutes. Also, the respondents were asked to abstain from smoking or intake of caffeine for at least thirty minutes before their appointment time.

III- Implementation phase:

The developed teaching module was conducted and applied individually for study subjects in the outpatient Cardiology Department using an interactive lecture with the illustrated colored module. The health teaching module was implemented in 2 successive sessions, one session per day for two consecutive days per week for six weeks. Each session lasted approximately 45-60 minutes. Initially, discussion of the session objectives and content were dedicated. Patients and their families were given time to participate and interact. Various teaching methods were used in the form of group discussions and interactive lectures. Teaching aids and guides prepared and utilized. The developed illustrated colored booklets were distributed to each patient in the implementation phase. At the end of each session, a brief summary was provided, emphasizing on the most important points. The Arabic illustrated booklet was used as teaching-learning aids during each session. The patients kept the booklet for remembering the instructions and being motivated for following it at home. Phone contacts were maintained between the investigator and patients to ensure follow up visit in the outpatient clinic

The first session, Content consisted mainly of theoretical aspects of the normal range of blood pressure, stages, complications, and prevention.

The second session: Content included information about DASH diet practices that improve blood pressure including the content of DASH diet, use of fruits, vegetables, low fat and stop smoking, instructions about walking exercise were provided for group B subjects.

IV- Evaluation phase:

Evaluation was carried out weekly for every study subject during follow up measurements for blood pressure using the same tools I, II as pre and post-tests. Comparisons of pre and post results were carried out using the appropriate statistical tests in order to determine the effect of implementing health teaching module on blood pressure for group (A) and group (B).

Ethical Considerations

- Informed written consents of the study subjects were obtained after explanation of the aim of the study.
- Privacy and anonymity were maintained for all participants.
- Confidentiality of the collected data was assured.
- Participation in the study was voluntary and the right to withdraw from the study at any time was confirmed.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. **(**Armonk, NY: IBM Corp**)**[32,33] Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean and standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were

- **Chi-square test:** For categorical variables, to compare between different groups
- **Fisher's Exact or Monte Carlo correction:** Correction for chi-square when more than 20% of the cells have expected count less than 5
- **Student t-test:** For normally distributed quantitative variables, to compare between two studied groups
- **Paired t-test:** For normally distributed quantitative variables, to compare between two periods.

III. RESULTS

Table (1) shows the **distribution of patients in both groups according to socio-demographic data.** The results revealed that no statistically significant differences were detected between both group subjects regarding age, sex, level of education, marital status, residence area, occupation, medical insurance and duration since hypertension occurred where the highest percentage of age in group A, B were between 50-60 years (53.3%, 63.3% respectively), from urban (90%, 86.7% respectively), secondary education (46.7% for both groups), hand manual work (30% both groups), had governmental medical insurance (50%, 66.7% respectively) and diagnosed with hypertension since 1-3 years (60%, 76.7% respectively).

Table (2) represents the **distribution of the two studied group subjects according to clinical characteristics.** The findings revealed that there were no statistically significant differences between both group subjects concerning the presence of any health problems, presence of other cardiovascular diseases, family history of any cardiac disease, smoking habits, and alcohol intake, (p= 0.071, 0.353, 0.489, 0.110, 0.492). Also, no statistical significant difference regarding practicing physical activity, frequency of exercise, activity during work, activity at home and frequent measuring of blood pressure as the highest percentages of groups A and B subjects rarely practicing exercises (100%, 93.3% respectively), sitting/simple activity <10 minutes (66.7%, 63.3 respectively), mostly relaxing at home (46.7% 43.3% respectively) and 50% of both group subjects were having regular intake of antihypertensive medication.

Table (3) shows comparisons between the two studied group subjects according to body mass index and blood pressure before the **teaching module.** There were no statistically significant differences between the two studied groups A and B regarding body mass index, systolic and diastolic BP before teaching program as p-value was (0.931, 0.793, 0.744 respectively).

Table (4) demonstrates comparisons between the two studied group subjects according to general knowledge and attitude towards the **DASH diet.** No statistical significant differences between the two studied group subjects regarding general knowledge of DASH diet and attitude pre-teaching module while there was a statistically significant difference between A and B post teaching regarding general knowledge of DASH diet as mean values were (9.83 ± 0.91), (10.33 ± 0.76) respectively with more improvement in group B (DASH + Walking) as p-value was (0.025). Also, a statistically significant differences were found regarding attitude towards the DASH diet post teaching between the two studied group subjects as p-value was (<0.001) with more improvement in group B.

Table (5) illustrates comparisons between pre and post teaching module according to blood pressure measurement in group A (DASH). A highly statistically significant differences were found between pre and post teaching module for systolic BP and diastolic blood pressure as the mean value of pre-teaching systolic BP was (153.0 ± 10.55) and for post-teaching was (141.8 ± 8.04) while the mean value for diastolic pre-teaching was (97.33 ± 8.68) and for post-teaching was (90.93 ± 5.09) where p-value (<0.001).

Table (6) shows comparisons between pre and post teaching module according to blood pressure in group B (DASH +walking). The table revealed a statistically significant difference between pre and post teaching program for systolic and diastolic blood pressure as the mean value of pre-teaching systolic BP was (152.3 ± 8.98) and for post teaching was (136.7 ± 7.03) while the mean value for diastolic pre-teaching was (97.0 ± 6.90) and for post teaching was (87.80 ± 5.03) where p-value (<0.001).

Table (7) elicits comparisons between the two studied group subjects according to BP measurements pre and post teaching. The findings revealed no statistically significant differences between systolic blood pressure in group A and systolic blood pressure in group B pre and post teaching while there was a statistically significant difference between diastolic BP in group A subjects and diastolic BP in group B subjects post teaching as mean values were (90.93 ± 5.09), (87.80 ± 5.03) respectively, with more improvement in group B (DASH + Walking) and p-value was (0.020).

Table (1): Distribution of patients in both groups according to socio-demographic data

A. Socio-demographic data	Group A (DASH) (n = 30)		Group B (DASH +waking) (n = 30)		Test of sig.	p
	No.	%	No.	%		
Age (years)						
30> 40	5	16.7	3	10.0	χ^2= 0.850	^{MC}p= 0.761
40>50	9	30.0	8	26.7		
50≥ 60	16	53.3	19	63.3		
Mean ± SD.	51.10 ± 8.40		53.13 ± 7.10		t=1.013	0.315
Sex						
Male	15	50.0	12	40.0	χ^2= 0.606	0.436
Female	15	50.0	18	60.0		
Residence						
Rural	3	10.0	4	13.3	χ^2= 0.162	^{FE}p= 1.000
Urban	27	90.0	26	86.7		
Education						
Illiterate	0	0.0	1	3.3	χ^2= 2.084	^{MC}p= 1.000
Read and wrote	10	33.3	9	30.0		
Primary and preparatory	5	16.7	6	20.0		
Secondary	14	46.7	14	46.7		
University	1	3.3	0	0.0		

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Occupation						
Not working	0	0.0	1	3.3		
Clerical work	7	23.3	8	26.7		
Retired	5	16.7	5	16.7	χ^2=	^{MC}p=
Businesses	2	6.7	0	0.0	2.763	0.839
Manual work	9	30.0	9	30.0		
House wife	7	23.3	7	23.3		
Marital status						
Single	6	20.0	2	6.7	χ^2=	^{MC}p=
Married	20	66.7	27	90.0	4.573	0.124
Widow	4	13.3	1	3.3		
Religion						
Moslem	27	90.0	25	83.3	χ^2=	^{FE}p=
Christian	3	10.0	5	16.7	0.577	0.706
Medical insurance						
Governmental	15	50.0	20	66.7		
Private	4	13.3	2	6.7	1.838	^{MC}p= 0.467
Without insurance	11	36.7	8	26.7		
Duration since hypertension occurred						
1-3 years	18	60.0	23	76.7		
4-6 years	7	23.3	7	23.3	5.507	^{MC}p= 0.075
7 and more	5	16.7	0	0.0		

χ^2: **Chi square test** MC: **Monte Carlo** FE: **Fisher Exact** **t: Student t-test**

p: p value for Comparing between the two studied groups *: Statistically significant at $p \leq 0.05$

Table (2): Distribution of the two studied group subjects according to patients clinical characteristics

Patient's clinical characteristics	Group A (DASH) (n = 30)		Group B (DASH +waking) (n = 30)		χ^2	p
	No.	%	No.	%		
Past health history						
Presence of any health problems						
None	18	60.0	11	36.7	3.270	0.071
Diabetes	12	40.0	19	63.3		
Presence of other cardiovascular disease						
None	26	86.7	29	96.7	1.964	^{FE}p= 0.353
Ischemic heart disease	4	13.3	1	3.3		
Family history of any cardiac disease						
None	28	93.3	29	96.7		
Hypertension	2	6.7	0	0.0	2.580	^{MC}p= 0.489
DM	0	0.0	1	3.3		
Smoking habits						
Not smoker	9	30.0	4	13.3		
Active smoker	**14**	**46.7**	**12**	**40.0**	4.410	0.110
Passive smoker	7	23.3	14	46.7		
Alcohol intake						
Yes	2	6.7	0	0.0	2.069	^{FE}p= 0.492
No	28	93.3	30	100.0		
Practicing physical activity						
Yes	0	0.0	2	6.7	2.069	^{FE}p=

No	30	100.0	28	93.3		0.492
Frequency of exercise						
Rarely	30	100.0	28	93.3	2.069	FEp= 0.492
1 – 2 days per week	0	0.0	2	6.7		
3 – 4 days per week	0	0.0	0	0.0		
≥5 days per week	0	0.0	0	0.0		
Activity during work						
Sitting/simple activity <10 minutes	20	66.7	19	63.3	0.535	MCp= 0.868
Moderate activity >10 minutes	5	16.7	7	23.3		
Vigorous activity >10 minutes	5	16.7	4	13.3		
Activity at home						
Mostly relaxing at home	14	46.7	13	43.3	2.028	0.363
Simple activity at home	13	43.3	10	33.3		
Moderate activity at home/outside	3	10.0	7	23.3		
vigorous activity at home/ outside	0	0.0	0	0.0		
Regular intake of anti-hypertensive medications	15	50.0	15	50.0	1.714	0.190
Frequent measuring of blood pressure						
Once per week	2	6.7	4	13.3	4.784	MCp= 0.173
Twice a week	1	3.3	2	6.7		
Three times a week	8	26.7	2	6.7		
Rarely	19	63.3	22	73.3		

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact**

p: p value for Comparing between the two studied groups *: Statistically significant at $p \leq 0.05$

Table (3): Comparisons between the two studied group subjects according to body mass index and blood pressure before teaching module

BMI, BP	Group A (DASH) (n = 30)	Group B (DASH +waking) (n = 30)	t	p
	Mean ± SD.	Mean ± SD.		
Body mass index (kg/m^2)	31.61 ± 4.03	31.69 ± 3.10	0.087	0.931
Blood pressure (mmHg)				
Systolic	153.0 ± 10.55	152.33 ± 8.98	0.264	0.793
Diastolic	97.33 ± 8.68	96.67 ± 6.99	0.328	0.744

t: Student t-test

p: p value for Comparing between the two studied groups

Table (4): Comparisons between the two studied groups according to general knowledge and attitude towards DASH diet

General manage and attitude towards DASH diet	Group A (DASH) (n = 30)	Group B (DASH +waking) (n = 30)	t	p
	Mean ± SD.	Mean ± SD.		
Pre teaching				
General knowledge of DASH diet				
Total score	5.17 ± 2.35	6.23 ± 2.06	1.868	0.067
% score	46.97 ± 21.36	56.67 ± 18.75		
Attitude towards DASH diet				
Total score	18.13 ± 2.24	19.03 ± 1.16	1.955	0.057
% score	86.35 ± 10.67	90.63 ± 5.52		

Post teaching (DASH)				
General knowledge of DASH diet				
Total score	9.83 ± 0.91	10.33 ± 0.76	2.308*	0.025*
% score	89.40 ± 8.30	93.94 ± 6.89		
Attitude towards DASH diet				
Total score	19.93 ± 0.37	21.0 ± 0.0	16.0*	<0.001*
% score	94.92 ± 1.74	100.0 ± 0.0		

t: Student t-test

p: p value for Comparing between the two studied groups

*: Statistically significant at p ≤ 0.05

Table (5): Comparisons between pre and post teaching module according to blood pressure measurements in group A (DASH)

Group A (DASH)	Pre teaching	Post teaching (DASH)	t	p
	Mean ± SD.	Mean ± SD.		
Systolic blood pressure (mmHg)	153.0 ± 10.55	141.8 ± 8.04	9.640*	<0.001*
Diastolic blood pressure (mmHg)	97.33 ± 8.68	90.93 ± 5.09	5.521*	<0.001*

t: Paired t–test

p: p value for Comparing between **Pre teaching** and **Post teaching (DASH)**

*: Statistically significant at p ≤ 0.05

Table (6): Comparisons between pre and post teaching module according to blood pressure measurements in group B (DASH +waking)

Group B (DASH +waking)	Pre teaching	Post teaching (DASH)	t	p
	Mean ± SD.	Mean ± SD.		
Systolic blood pressure (mmHg)	152.3 ± 8.98	136.7 ± 7.03	10.425*	<0.001*
Diastolic blood pressure (mmHg)	97.0 ± 6.90	87.80 ± 5.03	8.904*	<0.001*

t: Paired t–test

p: p value for Comparing between **Pre teaching** and **Post teaching (DASH)**

*: Statistically significant at p ≤ 0.0

Table (7): Comparisons between the two studied group subjects according to blood pressure measurements pre and post teaching

BP measurements	Group A (DASH) (n = 30)	Group B (DASH +waking) (n = 30)	t	p
	Mean ± SD.	Mean ± SD.		
Systolic blood pressure (mmHg)				
Pre teaching	153.0 ± 10.55	152.3 ± 8.98	0.264	0.793
Post teaching (DASH)	141.8 ± 8.04	136.7 ± 7.03	2.615	0.011
Diastolic blood pressure (mmHg)				
Pre teaching	97.33 ± 8.68	97.0 ± 6.90	0.165	0.870
Post teaching (DASH)	90.93 ± 5.09	87.80 ± 5.03	2.399*	0.020*

t: Student t-test

p: p value for Comparing between the two studied group

*: Statistically significant at p ≤ 0.05

IV. DISCUSSION

The results of the present study showed significant improvement in blood pressure measurements in group A (DASH) and group B (DASH and walking exercise). There was no significant difference in the pre-health teaching values but there were significant differences in the post health teaching values.

The significant improvement in blood pressure measurements detected in group A (receiving DASH) in the present study agreed with Ibbrahim [23] who confirmed that DASH substantially reduces the levels of blood pressure. The DASH – a diet focuses on high intake of vegetables, fruits, fish and foods with low levels of fat, milk derivatives, sugars, lean meat, and cholesterol substantially reduces the levels of blood pressure (BP), during the first eight weeks of compliance. Studies show that this reduction reaches 5.5 mmHg in systolic blood pressure and 3.0 mmHg in diastolic blood pressure during this period. [26]

The results of the present study were contradicted with that reported by Fuchs. (2010) who found low effectiveness of non-drug interventions in patients with hypertension and prehypertension. Randomized controlled trials with long follow-up have shown that the efficacy of dietary interventions is lost with time. Randomized clinical trials have shown that many nutritional and behavioral interventions are efficacious to reduce blood pressure; however, the effectiveness of such interventions is unsatisfactory.[34]

The significant improvement in blood pressure measurement in group B (receiving DASH and perform the walking exercise) for eight weeks in the present study agreed with Larsen and Matchkov, (2015), who examined the relationship between exercise and hypertension explaining theories of improving blood pressure. One theory is that physical activity ameliorates endothelial function. The endothelium lining of blood vessel walls maintains natural vasomotor tone, improves the liquidity of blood, and controls vascular growth as a result of blood pressure improved.[35]

Also, Lee et al., reported that diet and exercise, alone or combined, were effective in reducing the BP in subjects with prehypertension and hypertension, with improvements similar to drug therapy in patients with higher baseline BP levels. In the same context, Hagberg et al., on their review of 15 studies supported the recommendation that exercise training is an important initial or adjunctive step that is highly efficacious in the treatment of persons with mild to moderate elevations in BP. [36,37]

The significant improvement in blood pressure measurements in both group subjects in the present study was in agreement with the findings of Blumenthal et al., (2010) who tested the effects of DASH diet alone and in conjunction with exercise and weight reduction on blood pressure and cardiovascular biomarkers in males and females with hypertension. It was found that the addition of exercise and weight loss to the DASH diet resulted in even larger blood pressure diminution. Physical activity as walking exercise is considered as a natural, cheap, feasible, and effective means of control for hypertension and is a primary lifestyle measure essential to decrease blood pressure in hypertensive patients′. The supervised exercise routine consisted of ten minutes of warm-up workouts, thirty minutes of walking, and five minutes of cool-down exercises the study conducted for four months. [38,39]

In the present study the application of nutritional education in the group (A and B) lead to significant improvement in all items of general knowledge, knowledge about serving size and total knowledge about DASH diet. These results were consistent with those carried out by Orabi (2016), Pandey et al.,(2013) and Eghbali-Babadi,(2018) which indicated a significant increase in nutritional knowledge of the patients after the health teaching.[31,40,41]

In the same context, this study was compatible with findings of Habib et al., 2016 who revealed a substantial enhancement of knowledge of interventional group regarding general knowledge about DASH and knowledge about the serving size of DASH following the intervention done on hypertensive patients attending Dierb Negm hospital. [29] Also, the World Health Organization(WHO) described the health education as any combination of learning experiences designed to assist individuals and communities improve their health, enhance their knowledge or influence their attitudes.[2]

The current study also revealed that prior to intervention; there was no statistically significant difference in the attitude of the patients between the two groups. This may be attributed to the homogeneity of the sample studied in socio-demographic characters and educational level. This result was going with Mahajan et al., (2012) who reported that only five percent of patients agreed that the DASH diet eating plan is essential in hypertension controlling.[42]

In the present study the use of nutritional education for both group subjects led to significant improvement of patient's positive attitude. This result may be attributed to the improvement of subject's knowledge after health education. This result was consistent with Habib et al., (2016), Sabry et al., (2018), and Ozoemena1,et al (2019) [29,43,44]

Hence, the American Heart Association/American College of Cardiology has recommended six approaches with proven efficacy for the primary prevention of hypertension. These interventions include weight loss, dietary sodium reduction, increased physical activity, potassium supplementation and modification of whole diets.[45] In the same context, and in the study done by Ibbrahim,[23], about the dietary efficacy in reducing high blood pressure in hypertensive patients, who recommended that the necessity of a dietary approach is needed among all hypertensive patients as it could reduce both the workload for health care and the cost of therapy in the clinical field.

V. CONCLUSIONS

Patients who received diet approach DASH and walking exercises exhibited more improvement in the blood pressure than those who received diet approach DASH only.

VI. RECOMMENDATIONS

The following recommendations are forwarded:

1. The developed booklet about the DASH diet to improve blood pressure should be available and distributed to patients at the cardiology outpatient settings.

2. Nurses at the cardiology outpatient clinics are required to provide patients and family members with information regarding the DASH diet, walking exercise and other lifestyle modifications to improve blood pressure.

3. Pre and in-service training programs need to be developed for cardiology nurses to improve their knowledge.

4. Public health education and counseling programs need to be organized for hypertensive patients and their families about lifestyle modification to cope with hypertension.

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