DASH Diet: How Much Time Does It Take to Reduce Blood Pressure in Pre-hypertensive and Hypertensive Group 1 Egyptian patients?

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Abstract

Background: Dietary changes that lower blood pressure (BP) have the potential to prevent hypertension and more broadly to reduce BP, thus lowering risks of BP-related complications. Evidence shows that even a small reduction in BP could have enormous benefits.

Objectives: Evaluate the effect of Dietary Approaches to Stop Hypertension (DASH) diet on normotensive individuals; pre-hypertension and hypertensive grade 1 patients as well as to identify time needed for DASH to reduce BP in pre-hypertension and hypertensive grade 1 patients.

Methods: This study was a prospective interventional study carried out on 120 participants attending the out-patient clinic of a family medicine unit, of Dakahlia governorate, Egypt. Participants were equally distributed into three groups; normotensive, pre-hypertensive hypertensive grade 1 participants (40 in each group). Blood pressure and weight and waist circumference (WC) were measured at the beginning of the study then every 2 weeks for 16 weeks.

Results: Significant reductions in systolic and diastolic BP among pre-hypertension by (8.1, and 16.4 mmHg respectively with $P < 0.001$) and hypertensive participants by (5.8, and 7.4 mmHg respectively with $P < 0.001$) were observed. Reduction was greater in the first 8 weeks and reached a plateau after 12 weeks. BP decrease in normotensive group was insignificant. Additionally, there was insignificant reduction in weight and WC among the 3 groups.

Conclusion: Adherence to DASH diet has rapid and statistically significant improvement in systolic and diastolic blood pressure in hypertensive grade 1 and pre-hypertensive participants. Hence, DASH diet was found effective as a first line intervention of elevated blood pressure.

Keywords: DASH, Diet, Blood Pressure, Hypertension, Egypt

Introduction

The prevalence of prehypertension and hypertension among Egyptian adults has been reported as 57.2% and 17.6% respectively. Only 25.2% of the population had normal blood pressure levels of <120/80 mmHg. The highest prevalence of hypertension was found in Ismailia, Alexandria, Menya, Menoufia and Luxor governorates. The prevalence of hypertension among males and females was similar; however, females had a lower prevalence of prehypertension, and a higher prevalence of normal blood pressure, than males (1).

The STEPwise survey conducted in 2011-2012 recorded that the percentage of adult population with raised blood pressure, or currently on medication for hypertension (SBP ≥ 140 and/or DBP ≥ 90 mmHg), was 39.4%, with females showing higher percentage (40.8%) than males (38.7%). The percentage of population with raised blood pressure increased gradually with age, with the highest percentage (80.5%) among the age group of 55-65 years. Overall, the mean blood pressure was found to be 128/82 mmHg which is considered to be the state of pre-hypertension (2).

There is a gradual increase in cardiovascular risk as blood pressure (BP) increases above even "normal" values of 115/75 mmHg. For individuals aged 40 to 70 years, each increase of 20 mmHg of systolic BP or 10 mmHg of diastolic BP doubles the risk of cardiovascular disease (CVD). In controlled clinical trials, treatment of hypertension reduces the risk of congestive heart failure by 50%, stroke by 35% to 40% and myocardial infarction by 20% to 25% (3).

Dietary factors have an important role in BP homeostasis. In non-hypertensive and pre-hypertensive individuals, dietary changes that lower BP have the potential to prevent hypertension and more broadly to reduce BP and thereby lower the risk of BP-related complications. Even an apparently small reduction in BP, if applied to an entire population, could have an enormous beneficial impact. It has been estimated that a 3 mm Hg reduction in systolic BP could lead to an 8% reduction in stroke mortality and a 5% reduction in mortality from coronary heart disease. In uncomplicated stage I hypertension, dietary changes can serve as initial treatment before the start of drug therapy. Among hypertensive individuals who are already on drug therapy, dietary changes, particularly a reduced salt intake, can further lower BP and facilitate medication step-down. Therefore, the extent of BP reduction from dietary therapies is greater in hypertensive than in non-hypertensive individuals (4).

Although elevated blood pressure can be lowered pharmacologically, antihypertensive medications may be costly, must often be used in combination to achieve adequate blood pressure control, and can be associated with adverse effects that impair quality of life and reduce adherence (5). Although the Dietary Approaches to Stop Hypertension (DASH) diet and other healthy lifestyle changes may not be enough to control severe high blood pressure, yet they often lead to reduced need for blood pressure-lowering medications as well as lower doses of those medications (6).
The DASH diet emphasizes fruits, vegetables, and low fat dairy products; whole grains, poultry, legumes, fish, and nuts, and is reduced in fats, red meat, sweets, and sugar-containing beverages. It is therefore rich in potassium, magnesium, calcium, and fiber and reduced in total fat, saturated fat, and cholesterol. It is also characterized by slightly increased protein content. It is likely that several aspects of the DASH diet, rather than just one nutrient or food, reduces blood pressure (7).

This study aimed at testing the following hypothesis: Adherence to DASH diet causes a significant reduction in systolic and diastolic BP in both study groups (pre-hypertension and hypertensive group 1 patients), and a non-significant reduction among normotensive group. Therefore, DASH diet can cause even more improvement in other risk factors of hypertension. Hence this study aimed at answering the following research questions: Does DASH diet have an effect on systolic and diastolic blood pressure in normotensive individuals, pre-hypertension and hypertensive group 1 patients, and how much time does the DASH diet need to decrease BP in pre-hypertensive and hypertensive patients?

Objectives

1- Evaluate the effect of DASH diet on normotensive individuals; pre-hypertension patients and hypertensive grade 1 patients.
2- Assess time needed for DASH diet to reduce the blood pressure in pre-hypertension patients and hypertensive grade 1 patients.

Methods

Study design:
The study employed a prospective interventional design to evaluate the effect of Dietary Approaches to Stop Hypertension (DASH) diet on Normotensive, Pre-hypertension and Hypertensive grade 1 patients.

Study site and subjects:
The study was conducted in a family medicine unit (FMU) that provides primary health care services in the rural area of Sherbeen, of Dakahlia governorate, Egypt. The study site was purposefully selected because it serves 7 villages, with different socioeconomic levels. Additionally, the unit has a high rate of outpatient visitors (average 30 person/day) seeking different medical services. The health unit was visited on three days per week regularly from June, 2012 till February, 2013. An advertisement was distributed throughout the FMU, announcing to all clients the subject of research and its benefits to help control blood pressure. The inclusion criteria for study participants were as follows: Age between 30 - 60 years; systolic blood pressure <160 mmHg, and diastolic blood pressure <100 mmHg; both sexes; participants willing to follow the advice related to life style modifications. Exclusion criteria for the study participants were: Any age below 30 years, or above 60

years, grade 2 hypertension (systolic > 160 mmHg, diastolic > 100 mmHg), patients with terminal organ failure, history of major cardiovascular events (cerebrovascular accidents), patients with renal disease, pregnant women, patients taking medications that would alter blood pressure as oral contraceptives pills, corticosteroids, hormonal replacement therapy, anti-depressive medications, routine use of aspirin or non-steroidal anti-inflammatory drugs.

Study participants were then classified into three groups, Group 1: normotensive group with (systolic < 120 mmHg, diastolic < 80 mmHg); Group 2: pre hypertensive group with (systolic 120 - 139 mmHg, diastolic 80 - 89 mmHg); and Group 3 hypertensive grade 1 group with (systolic 140 - 159 mmHg, diastolic 90 -99 mmHg). The grade of the disease was identified from the FMU patient records. Initial recruitment of subjects started then follow-up continued for the next 16 weeks (every 2 weeks). All participants underwent focused medical examination for initial screening before recruitment.

Sample Size and technique:

The sample size was calculated according to the flow of FMU clients as obtained from the FMU records. The number of clients ranged between 20-30 per day, with average of 400-600 visitors /month. For the purposes of the study, every participant needed half an hour to fill out the questionnaire and to measure BP, weight, height, and waist circumference. Hence 10 participants were recruited per day. Enrolment stopped when the number of subjects recruited reached a predetermined sample size of 120 equally distributed among the study groups. Using a systematic random technique over the working days, every 5th patient was approached and asked first verbally for consent to undergo initial screening and participate in the study if found to be eligible. All patients fulfilling the inclusion criteria were asked to share their telephone numbers with the research team for ease of follow up. Participants were recruited for an initial duration of 5 weeks. At the end of the initial recruitment phase a total of 120 individuals were recruited (40 in each group).

Study tools and measurements:

a- Structured questionnaire:

A pre-coded structured questionnaire was used to assess the socio-demographic characteristics, dietary and behavioral information as well as medical information. Demographic data included (age, gender, education, occupation, marital status). Behavioral and dietary information included alcohol intake, physical activities, food taste preferences, cigarette smoking, and frequency of intake of various kinds of foods. All participants were asked about the previous 3-day food record prior to their participation in the study. During the first encounter, participants were interviewed to assess if their diet was unchangeable, using their 3-day food record as a basis for their habitual diet. For example, if they felt unable to decrease their salt intake or increase their fruit and vegetable intake sufficiently, then they were excluded from the study. A total of 120 participants who were judged capable of making the necessary dietary changes were recruited into the study.

b- Anthropometric measurements:

Anthropometric measurements were completed using standardized procedures and were documented in a special checklist developed for the purpose of the study.

- The waist circumference (WC) was measured to the nearest 0.1 cm using a non-stretchable measuring tape passing halfway between the lower border of the ribs and iliac crest, with the tape horizontal through the umbilicus. WC was measured every month for the subsequent 4 months of the study.
- Body weight (WT) was measured to the nearest 50 gram; subjects were in light clothing without shoes, and a standard balance scale was used. Height (HT) was measured with subjects standing fully erect on a flat surface looking straight ahead, with heels, buttocks and shoulders flat to the wall, without shoes; measurements were to the nearest 0.5 centimeter, and a tape was used. The body mass index (BMI) was calculated as the weight in (kilograms) divided by the height in (meters squared) (kg/m2).
- The Blood pressure was measured in the right arm, with the participant in a seated posture with feet on the floor and arm supported at heart level, after at least 5 minutes of rest (8). An appropriate size of cuff and a standard mercury sphygmomanometer were used. A large size cuff was used with obese participants. Two readings each of systolic BP (SBP) and diastolic BP (DBP) were recorded; Participants were advised to evacuate bladder and to stop consuming coffee, tea, or smoking cigarettes, for at least 30 minutes before the BP readings. These measurements with the same precautions were repeated every 2 weeks for the subsequent 4 months of the study. All the sphygmomanometers were checked and calibrated before use.

Study Intervention:

The DASH diet tool as proposed by Hinderliter et al, 2011 (7), was used. The diet was explained on the first day, and started the following day for 16 weeks. Subjects were requested to build up the diet during the first week of the study period to the required number of portion sizes for a DASH-style diet, which they would then maintain for the further study period. This was done to minimize the gastrointestinal side effects of suddenly increasing non-starch polysaccharide. The participants were asked to come to the FMU every 2 weeks to check their blood pressure, and for counseling and discussions regarding the diet. Energy balance was aimed for, and the importance of maintaining a constant body weight was stressed. The study diet was based on the DASH intermediate sodium diet but altered to fit participant's food preferences and portion sizes. Greatest emphasis was placed on consuming the fruits, vegetables and low-fat dairy foods, whole grains, poultry, fish, as well as the salt restriction and weight maintenance. The importance of reducing saturated fat, red meat and refined carbohydrate and increasing complex carbohydrate intakes was also stressed. Suggestions on how to increase fruit and vegetable consumption were also provided. All smokers were advised to quit smoking, and counseling

on smoking hazards was conducted. Instructions were given regarding reducing sodium intake. The level of sodium intake that was aimed for was 2300 mg or less (1 teaspoonful), which was the intermediate level used in the DASH sodium trial (9). Subjects were requested to avoid foods with a high salt content and not to add salt during cooking or at the table. They were shown how to interpret food labels, particularly with regard to sodium content. Guidance as to how to add flavor without using salt was given. Subjects were requested to restrict their coffee and tea intake to not more than six cups a day. If their habitual intakes were higher than these levels, they were asked to reduce to these recommended levels. Under participant's request, diets were organized in sheets according to their needs. Subjects were requested to keep their exercises as usual without any changes.

Data management and statistical analysis:
The pre-coded questionnaires were entered for analysis on SPSS package version 11.0. for quantitative data analysis. Simple frequencies were used for data checking. According to Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (10) all of the following cut-off points were used in the study:

- Age of study participants was categorized into 2 age groups, below 35 years old and above 35 years old.
- Hypertension was identified according to the following criteria:
  - Normotensive group (systolic < 120 mmHg, diastolic < 80 mmHg),
  - Pre-hypertension group (systolic 120 - 139 mmHg, diastolic 80 - 89 mmHg),
  - Hypertensive grade 1 (systolic 140 - 159 mmHg, diastolic 90 - 99 mmHg).

Compliance with Ethical Standards:
The study was approved by the Family Health and Public Health Councils. Selected members constituted the internal review board to guarantee the ethical conformity of the study. Informed verbal consent was obtained from all the participants before recruitment in the study, after explaining the objectives of the work and procedures. All questionnaire forms and clinical sheets were coded to preserve confidentiality that was also guaranteed on handling the data base according to the revised Helsinki declaration of biomedical ethics (11). All participants were informed about the results of their medical examination. Those who were found hypertensive grade 2 were referred to the unit health team for drug prescription, and further follow up.

Results

The study included 120 participants of which 56.7% were females. Participants were equally distributed among the study groups. The mean age of participants in the hypertensive group was found to be significantly older than those in the other two study groups with a mean age of 45.5 ± 7.7 years compared to 39.5 ± 8.3years and 40.2 ± 7.8 years for participants in the normotensive and pre-hypertension groups, respectively (P = 0.001). The age of most of the study participants were more than 35 years old (72.5%) of which 28.7% were normotensive, 31.1% were pre-hypertension and 40.2% were hypertensive. Only 46.6% of all participants had higher education, of which 32.1% were normotensive, 39.3% were pre-hypertension and 28.6% were hypertensive. Moreover 41.7% of all participants had basic education, of which 34.0% were normotensive, 28.0% were pre-hypertension and 35.7% were hypertensive. There was no significant difference between the study groups regarding gender, marital status, education or occupation [Table 1 - next page].

As regards systolic blood pressure (SBP) readings, the base line reading for normotensive group was 105.3 ± 8.0 mmHg, and then at the end of the study it became 102.0 ± 6.3 mmHg, with mean change 3.3 ± 5.0 mmHg. For the pre-hypertension group, it was 124.3 ± 5.0 mmHg. That became 116.1 ± 5.7 mmHg, with mean change 8.1 ± 5.6 mmHg. As for the hypertensive group it was 146.0 ± 5.8 mmHg, and became 129.6 ± 13.5 mmHg, with mean change 16.4 ± 11.7 mmHg. Although there was no significant change in the normotensive group readings (P = 0.47), there were statistically significant changes in pre-hypertension and hypertensive readings (P <0.001). When comparing the mean change in systolic blood pressure readings among all study groups, a highly significant difference was detected (P < 0.001) with the hypertensive group showing the highest reduction followed by the other two groups. This difference was found across the three groups [Table 2 - next page].

Figure 1 (page 17) displays the mean SBP readings for the study groups, across the follow up period of the study. The effect of DASH diet was most evident on the hypertensive group, where the mean SBP was reduced from 146 mmHg at base line to 129.6 mmHg at the end of 16 weeks and this reduction reached a plateau at 12 weeks.

Regarding the diastolic blood pressure (DBP) readings, the base line reading for the normotensive group was 69.5 ± 4.5 mmHg that became at the end of the study 68.4 ± 3.6 mmHg, with mean change 1.1 ± 2.1 mmHg. Similarly it was 80.8 ± 2.7 mmHg, then 75.0 ± 4.8 mmHg, for pre-hypertension group with mean change 5.8 ± 4.2 mmHg, and was 85.6 ± 5.5 mmHg then 78.3 ± 6.7 mmHg with mean change 7.4 ± 7.1mmHg for hypertensive group. There was no significant change in normotensive group readings (P = 0.83), however, there was a significant change in pre-hypertension and hypertensive groups (P < 0.001). Comparing the mean change in diastolic blood pressure, a highly significant difference was detected (P < 0.001). The hypertensive group showed the highest reduction, followed by the other two groups. The difference was found between the hypertensive and pre-hypertension groups in comparison to the normotensive group [Table 2].

Figure 2 shows the mean DBP readings for the study groups across the follow up period of the study. Both the hypertensive and the pre-hypertension groups started at

Table 1: Socio-demographic characteristics of the study participants

Variables		Study groups						Total		p. Value
		Normotensive		Pre-hypertensive		Hypertensive				
		N.	%	N.	%	N.	%	N.	%	
Gender	Male	17	32.7	16	30.8	19	36.5	52	43.3	0.79
	Female	23	33.8	24	35.3	21	30.9	68	56.7	
Age Groups	<35ys	15	45.4	13	39.4	5	15.2	33	27.5	0.001
	>35ys	25	28.7	27	31.1	35	40.2	87	72.5	
Marital Status	Married	31	30.7	34	33.7	36	35.6	101	84.2	0.35
	Unmarried	9	47.4	6	31.6	4	21.0	19	15.8	
Education	Illiterate	5	35.7	4	28.6	5	35.7	14	11.7	0.47
	Basic	17	34.0	14	28.0	19	38.0	50	41.7	
	Higher	18	32.1	22	39.3	16	28.6	56	46.6	
Occupation	Not working	11	32.4	12	35.3	11	32.3	34	28.3	0.32
	Public sect.	11	28.9	9	23.7	18	47.4	38	31.6	
	Private sect.	6	46.1	4	30.8	3	23.1	13	10.8	
	Technician	7	46.7	6	40.0	2	13.3	15	12.5	
	Professional	5	26.3	9	47.4	5	26.3	19	15.8	

Table 2: Effect of DASH diet on mean systolic and diastolic blood pressure readings among the study groups

Variables		Study groups			P. Value for mean change
		Normotensive	Pre-hypertensive	Hypertensive	
Systolic Blood Pressure	Base line	105.3 ± 8.0	124.3 ± 5.0	146.0 ± 5.8	
	Final	102.0 ± 6.3	116.1 ± 5.7	129.6 ± 13.5	
	P. Value	**0.47**	**<0.001**	**<0.001**	
	Mean change	-3.3 ± 5.00	-8.1 ± 5.6	-16.4 ± 11.7	**<0.001**
Diastolic Blood Pressure	Base line	69.5 ± 4.5	80.8 ± 2.7	85.6 ± 5.5	
	Final	68.4 ± 3.6	75.0 ± 4.8	78.3 ± 6.7	
	P. Value	0.83	<0.001	<0.001	
	Mean change	-1.1 ± 2.1	-5.8 ± 4.2	-7.4 ± 7.1	**<0.001**

Figure 1: Follow up of mean systolic blood pressure, among study groups, during the duration of the study

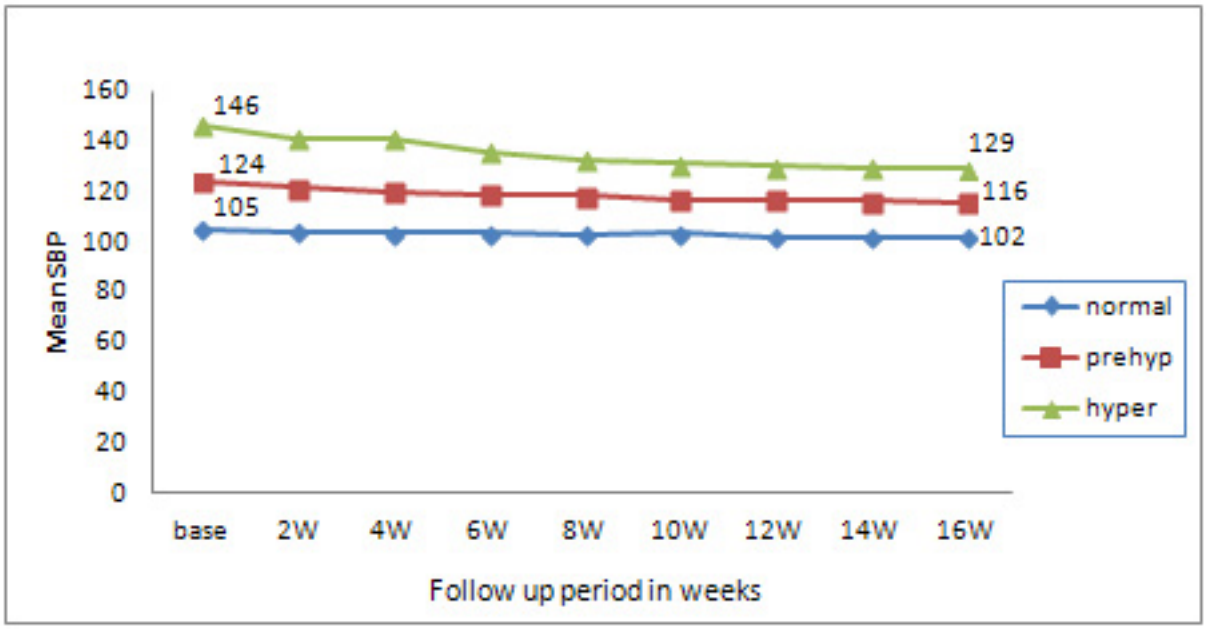


Figure 2: Follow up of diastolic blood pressure, among study groups during the duration of the study

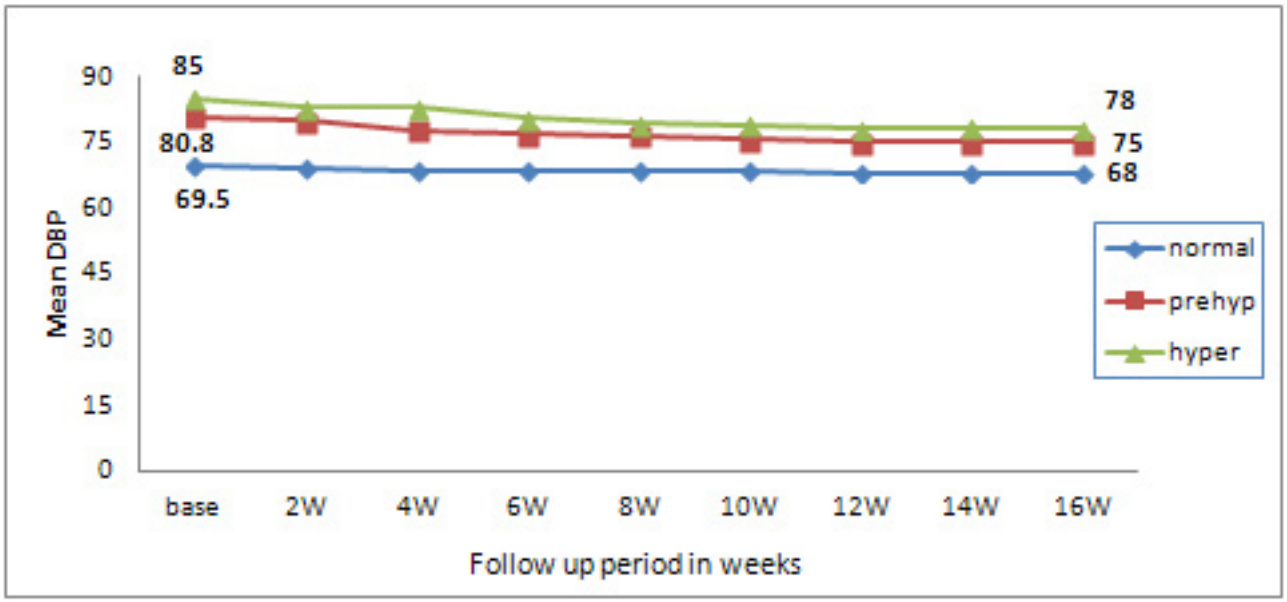


Table 3: Effect of DASH diet on waist circumference of males and females of the study groups

Waist circumference		Study groups			P. Value for mean change
		Normotensive	Pre-hypertensive	Hypertensive	
Male	Base line	97.6 ± 9.4	95.9 ± 10.4	102.1 ± 11.5	
	Final	96.3 ± 8.8	94.8 ± 10.6	100.1 ± 10.9	
	P. Value	**0.70**	**0.76**	**0.58**	
	Mean change	-1.3 ± 0.9	-1.1 ± 0.5 cm	-2.0 ± 0.8	**0.33**
Female	Base line	97.7 ± 14.2	103.0 ± 12.2	108.9 ± 16.7	
	Final	95.4 ± 21.9	100.7 ± 11.3	107.5 ±16.1	
	P. Value	**0.29**	**0.50**	**0.69**	
	Mean change	-2.3 ± 0.4	-2.3 ± 0.7	-1.4 ± 0.6	**0.14**

above 80 mmHg and reached 78.3 mmHg and 75.0 mmHg respectively, at the end of the study period with a plateau at 12 weeks.

The mean waist circumference (WC) among males in the normotensive group at base line was 97.6 ± 9.4 cm, and then became 96.3 ± 8.8 cm at the end of the study. Similarly WC was 95.9 ± 10.4 cm for the pre-hypertension group, that became 94.8 ± 10.6 cm, and was 102.1 ± 11.5 cm, then became 100.1 ± 10.9 cm for the hypertensive group [Table 3]. Although there was a slight mean decrease in the mean male WC of the base line reading by about 1.3 ± 0.9 cm, 1.1 ± 0.5 cm, 2.0 ± 0.8 cm in normotensive, pre-hypertension, hypertensive groups respectively, there was no statistically significant difference in the male waist circumference response. The mean WC for females at base line was 97.7 ± 14.2 cm, to end at 95.4 ± 21.9 cm for the normotensive group. As for the pre-hypertension group it was 103.0 ± 12.2 cm, that became 100.7 ± 11.3 cm, and it was 108.9 ± 16.7 cm, and became 107.5 ± 16.1 cm for the hypertensive group [Table 3]. A slight decrease in the mean female WC base line readings by 2.3 ± 0.4 cm, 2.3 ± 0.7 cm 1.4 ± 0.6 cm in normotensive, pre-hypertension, hypertensive groups respectively was found, however these findings were statistically insignificant. Similar findings with reductions in body weight and body mass index were detected although these were also statistically insignificant [Table 4].

Figure 3 shows the mean male WC readings for the study groups across the follow up period of the study. Both the hypertensive and the pre-hypertension groups started at above 97 cm and reached 100.1 and 96.3 cm respectively, at the end of the study period. Although the decrease in WC was insignificant, it continued throughout the 14 weeks.

Figure 4 shows the mean female WC readings for the study groups across the follow up period of the study. Both the hypertensive and the pre-hypertension groups started at above 103cm and reached 100.7 and 107.5 cm respectively, by the end of the study period. The decrease in WC was also insignificant but continued throughout the 14 weeks.

Discussion

The National Institutes of Health, in the USA, developed the Dietary Approaches to Stop Hypertension (DASH) eating plan, which has been shown to reduce blood pressure and body weight as well as prevent chronic diseases (12). This study explored the effects of a DASH diet intervention among three groups of Egyptian patients. Reductions in both systolic and diastolic blood pressure readings were found in all groups of normotensive, pre-hypertension and hypertensive grade 1 participants. However, reductions were significantly greater among the hypertensive grade I and pre-hypertensive group compared to the normotensive group.

These findings concur with results of Getchell et al, 1999 where 459 adults who were hypertensive and non-hypertensive were included and the study applied three types of diets: (1) a control diet with a nutrient composition typical of that consumed by Americans; (2) a DASH diet rich in fruits, vegetables, and low fat dairy products with a reduced amount of saturated fat, total fat, and cholesterol and a modestly increased amount of protein; and (3) a diet rich in fruits and vegetables but otherwise similar to the control diet. It was found that in comparison to the control group, blood pressure reduction was greater in those who were hypertensive on entry to the study. Additionally, for participants following the DASH diet, the amount of

Table 4: Effect of DASH diet on mean body weight and body mass index readings among the study groups

Variables		Study groups			P. Value for mean change
		Normotensive	Pre-hypertensive	Hypertensive	
Body Weight readings	Base line	79.7 ± 14.5	85.5 ± 13.4	94.0 ± 23.3	
	Final	77.5 ± 13.2	83.0 ± 12.5	91.2 ± 22.5	
	P. Value	**0.96**	**0.90**	**0.99**	
	Mean change	-2.2 ± 2.5	-2.6 ± 2.4	-2.7 ± 3.0	**0.64**
BMI readings	Base line	28.5 ± 4.8	30.4 ± 5.1	33.4 ± 8.2	
	Final	27.7 ± 4.2	29.5 ± 4.6	32.4 ± 7.9	
	P. Value	**0.94**	**0.92**	**0.98**	
	Mean change	-0.8 ± 0.9	-0.9 ± 0.9	-1.0 ± 1.0	**0.67**

Figure 3: Follow up of mean male waist circumference, by study groups

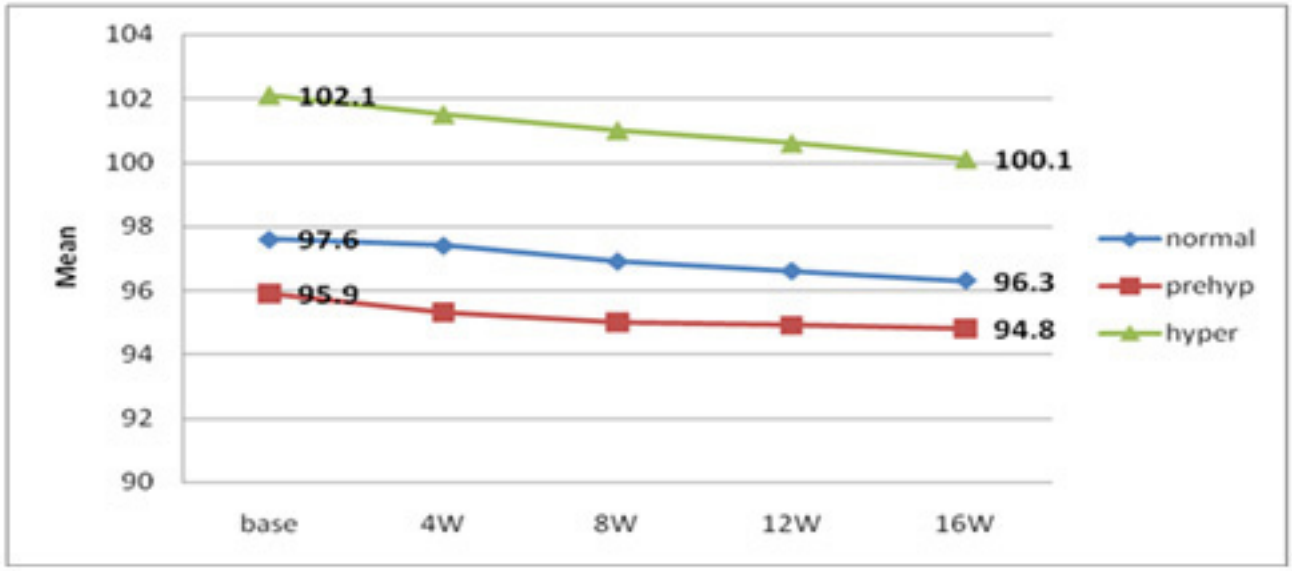
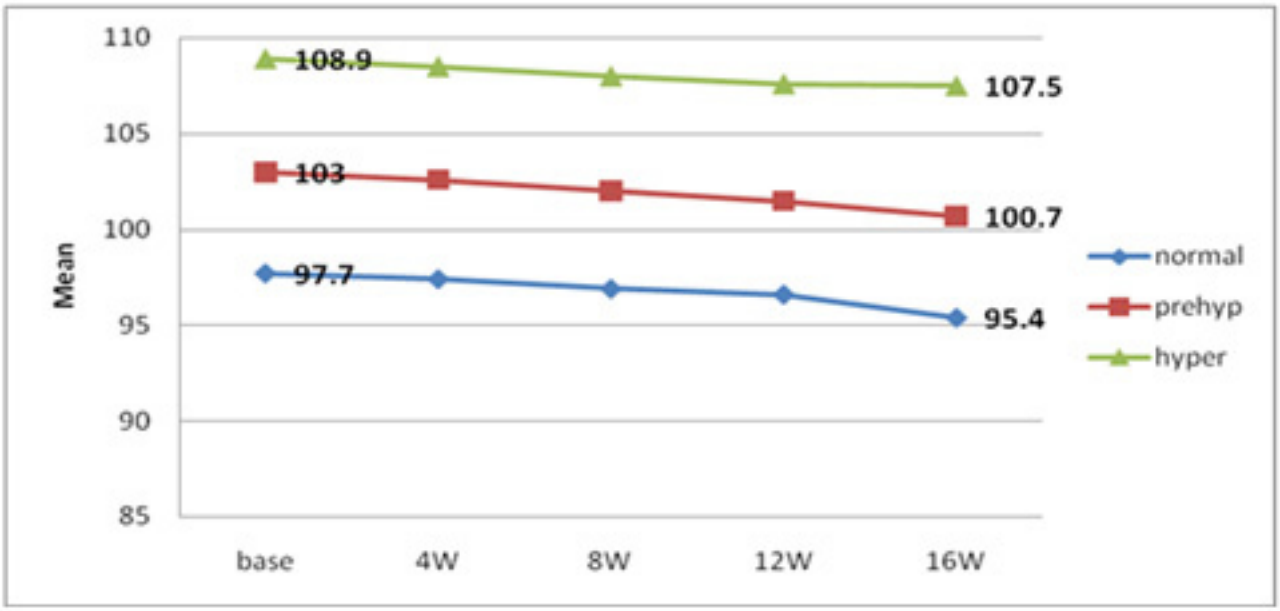


Figure 4: Follow up of female mean waist circumference, by study groups



blood pressure reduction increased significantly as baseline blood pressure increased (13). In addition, the study of Harnden et al, 2010 that applied a DASH diet for 30 days in the UK showed a weight reduction with an associated significant reduction in the mean systolic and diastolic blood pressure (14).

As regards the effect of DASH and time to reduction of both systolic and diastolic blood pressure, findings of our study showed major significant reductions in the BP among pre-hypertensive and hypertensive group 1 patients were greater in the first 8 weeks reaching a plateau after 12 weeks till the end of the study. Similar results were reported by Craddick et al, 2003 who found that DASH diet quickly and significantly reduces blood pressure, in comparison to the control (ordinary) diet among adults diagnosed as pre-hypertensive and hypertensive grade 1. These results were obtained without requiring participants to lose weight or reduce their sodium intake (15). Earlier Vollmer et al, 2001 reported on proven strategies for reducing blood pressure as confirming the DASH diet, and reducing sodium intake among other strategies. Adopting each alone or in combination would reduce the risks of high blood pressure. However, this requires long-term commitment and significant lifestyle change to be effective (16). In 2007, Dauchet et al, found in a cross-sectional analysis, that measured intake of fruits, vegetables, and dairy products which are the components of DASH diet, are associated with a lowered systolic blood pressure by 1.5 mmHg and diastolic blood pressure by 1.4 mmHg (17).

In our study, there was a slight decrease in the mean WC in normotensive, pre-hypertension, hypertensive groups. Although this was insignificant yet it continued throughout the 14 weeks of the study. Additionally, slight reductions were also found regarding body weight and BMI following compliance to the DASH diet that although insignificant, may have also helped in reducing blood pressure among

study participants. Data from the ENCORE study suggest that the DASH eating plan alone lowers blood pressure in overweight individuals with high blood pressure, but significant improvements in insulin sensitivity are observed only when the DASH diet is implemented as part of a more comprehensive lifestyle modification program that includes exercise and weight loss (18). DASH is thus preferred as the initial approach to treating most individuals with uncomplicated higher than optimal blood pressure.

Conclusion

Various DASH studies have demonstrated that the total eating pattern, including sodium and other nutrients and foods, affects blood pressure and is also associated with a reduced risk of cardiovascular disease and lowered mortality (12, 19). This study provides evidence for the beneficial health outcomes among adults that have confirmed our intervention. Results have shown that DASH diet reduces blood pressure among all participants but with more effect among those with higher blood pressure levels. DASH diet as a monotherapy is known to be an effective and rapid initial treatment for patients with mild hypertension. As an intervention, it alleviates the cost and side effects associated with antihypertensive medications, ultimately improving a patient's quality of life. Therefore, the study recommends that family physicians begin with it as a first step for primary prevention or secondary prevention in mildly uncomplicated hypertensive patients and determine its efficacy after 8 -12 weeks. While other lifestyle modifications such as smoking cessation require greater time and personal effort, adherence to the DASH diet program can be encouraged through health education, enhancing family support and frequent counseling.

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