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Dietary Patterns and Their Association with Blood Pressure Control among Hypertensive Patients in Gaza Strip, Palestine

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Abstract: Background: Silent killer, or hypertension, rarely has noticeable symptoms. But if untreated, it increases the risk of serious problems such as heart attacks and strokes. Globally, the World Health Organization estimates that, the overall prevalence of hypertension was around 40% in adults. However, the role of diet in the origin of hypertension is not understood well. Therefore, the purpose of the current study was to identify major dietary patterns among hypertensive patients and its association with blood pressure control in Gaza Strip, Palestine. Methods: This cross sectional study was conducted among a representative sample of Palestinian hypertensive patients (both genders, aged 30 - 64 years), patients receiving care in the primary healthcare centers in Gaza Strip, Palestine. Dietary patterns were obtained using factor analysis. Data regarding other variables was collected using an interview-based questionnaire. Statistical analysis was performed using SPSS version 20. Results: Two major dietary patterns were identified, including: Asian-like pattern and sweet-soft drinks-snacks pattern. After adjustment of potential confounders, patients in the lowest tertile of the Asian-like pattern had a lower odds for high systolic blood pressure, (OR 0.970 CI 95% (.951-.990)), (P value < 0.05). No significant association was found between the Asian-like pattern with diastolic blood pressure. In addition, no significant associations were found between the sweet-soft drinks snacks pattern and blood pressure. Conclusion: The Asian-like pattern characterized by a high consumption of whole grains, potatoes, vegetables, fruit and olive may be associated with a lower prevalence of systolic blood pressure among hypertensive patients. Further future studies are required to confirm these findings.

Keywords: Blood Pressure, Dietary Patterns, Factor Analysis, Hypertension, Palestine

1. Introduction

Silent killer, hypertension or raised blood pressure (BP) is an important global health challenge [1-3]. Hypertension is the leading preventable risk factor for premature death and disability worldwide [3]. Raised BP is a major risk factor for coronary heart disease and ischemic as well as hemorrhagic stroke [4]. In addition, complications of raised BP include heart failure, peripheral vascular disease, renal impairment, retinal hemorrhage and visual impairment [4]. Globally, cardiovascular disease accounts for approximately 17 million deaths a year, nearly one third of the total [5]. Hypertension account for 9.4 million deaths worldwide every year [6]. Hypertension is responsible for at least 45% of deaths due to heart disease, and 51% of deaths due to stroke [5]. Globally, the World Health Organization estimates that, the overall prevalence of hypertension was around 40% in adults [4]. It disproportionately affects populations in low- and middle-income countries where health systems are weak [7]. In Palestine, the prevalence of hypertension was 27.6% among the registered Palestinian refugees [8]. Treating systolic and diastolic BP until they are less than 140/90 mmHg is associated with a reduction in cardiovascular complications [4]. Addressing behavioral risk factors, e.g. unhealthy diet,

harmful use of alcohol and physical inactivity, can prevent hypertension [7]. Recently, diet-disease relations have been recommended to be looked for through dietary pattern approach [9-11]. Dietary pattern analysis allows consideration of the entire diet, rather than individual foods or ingredients [12]. Furthermore, the dietary pattern approach reflects individuals dietary behaviors and therefore can provide more detailed information about nutritional etiology of chronic diseases [9-11]. Diet is one of the lifestyle factors that may play an essential role in preventing and managing of hypertension [13-14]. Furthermore, few studies have examined the association between dietary patterns and BP control. Most of the previous studies have examined the associations between a single food or nutrients and hypertension [15-18]. Therefore, understanding the relationship between dietary patterns with BP control may be useful in decreasing hypertension-related morbidity and mortality among hypertensive patients. To the best of our knowledge, this is the first study, which examined this association among hypertensive patients in Gaza Strip, Palestine. The purpose of the current study was to identify major dietary patterns among hypertensive patients and its association with BP control.

2. Methods

2.1. Study Population

The study population comprised of 765 hypertensive patients, aged 30 - 64 years, were included in a cross sectional study. In the years 2015 and 2016, a representative sample of participants were selected by a cluster random sampling methods from the primary healthcare centers (PHCs) in Gaza Strip, Palestine. The total number of PHCs in Gaza Strip is fifty-four [19]. Gaza Strip is divided into five smaller governorates and the study sample in our study was divided according to the number of PHCs in each governorate. Pregnant, nursing mothers and participants with other type of serious diseases like cancer, acute myocardial infarction or end-stage kidney disease were eliminated from the study. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences and by the Palestinian Health Research Council. Furthermore, a written informed consent was obtained from all participants. Confidentiality was respected throughout the study.

2.2. Assessment of Anthropometric Measurements

Height (cm), weight (kg) and waist circumference (cm), were measured for all participants using standard methods [20]. In addition, body mass index (BMI) was estimated by dividing weight (kg) by the square of height in meters.

2.3. Blood Tests and Lab Analysis

After 12 hours fasting, blood sample of all participants were collected through venipuncture by a registered nurses and was used for blood chemistry analysis. Serum was separated immediately, and the extracted serum was investigated for (High-Density Lipoprotein Cholesterol (HDL-c) mg/dl and Triglycerides (TGs) mg/dl). The laboratory tests were analyzed in a licensed laboratory.

2.4. Blood Pressure Assessment

The BP measurement was took from the left arm (mmHg) using a stethoscope and mercury sphygmomanometer. Three readings on different days, while the patient was seated after relaxing for at least fifteen minutes in a quiet environment, empty bladder, without having smoked or consumed any coffee, tea, beverage that contains high levels of caffeine or any other food. The average of three measurements was recorded. In the present study, raised BP (Hypertension), was defined according to the World Health Organization definition, as a systolic BP equal to or above 140 mmHg and/or diastolic BP equal to or above 90 mmHg or treatment of previously diagnosed hypertension [4].

2.5. Dietary Assessment

A comprehensive data regarding dietary patterns were collected by an expert nutritionist, using a validated semi-quantitative food frequency questionnaire (FFQ). The FFQ is relatively easy and inexpensive to administer and can be used to measure dietary intake over a prolonged time period [21-22]. In the present study the FFQ contains a list of 98 food items; it was developed and validated among Palestinian population in 2014 [23]. In our study, the method of dietary patterns assessment was published in the previous study [20]. Furthermore, the major dietary patterns were obtained using factor analysis after the classification of food items into 25 groups (Table 1).

2.6. Covariates Assessment

The socioeconomic, demographic and behavioral data were collected through an interview-based questionnaire. Past medical history and the usage of antihypertensive medications was also investigated. In addition, reports and all relevant documentation, including medical records were checked. Data about physical activity were collected using the International Physical Activity Questionnaire (IPAQ short version) [24]. The internationally accepted protocol was used to estimate the weekly calorie expenditure expressed as metabolic equivalents per week (MET/wk) [24]. According to the IPAQ scoring protocol, the patients were classified based on their weekly energy expenditure as follows: Insufficiently Active (IA) ≤600 MET/wk; Sufficiently Active (SA) 601 to 1500 MET/wk, and Very Active (VA) ≥1500 MET/wk [25]. Pilot study was conducted on thirty patients to evaluate the tools of the study. Then, the tools of the study were modified according to the result of the pilot study.

2.7. Statistical Analysis

All statistical analysis was performed using SPSS version 20. Dietary intakes were converted into grams per day. Factor analysis was performed to determine the major dietary patterns among hypertensive patients. Factor analysis is a useful multivariable statistical tool for investigating dietary patterns

[26-27]. It allows researchers to investigate concepts that are not easily measured directly by collapsing a large number of variables into a few interpretable underlying factors [28-29]. This data reduction method identifies independent vectors of variables in a correlation matrix and provides scores that allow individuals to be ranked in terms of how closely they conform to the total pattern [30]. In our study, the 98 food items in the FFQ were classified into 25 food groups (Table 1). The food grouping was based on the similarity of nutrient profiles and was somewhat similar to that used in previous studies [31-32]. A varimax rotation was used to determine the dietary patterns. For defining food groups in each pattern and simplifying dietary pattern tables, factor loads under 0.2 were excluded [33]. The factor load shows the association between food groups and dietary patterns. For determining the number of factors, we considered eigenvalues > 1, the scree plot, and the interpretability of the factors. When a food group was loaded in more than one dietary pattern, only the pattern with a higher factor load was considered in the analysis. A factor score for the two major dietary patterns was calculated. This score for each individual shows, the extent to which the dietary pattern is consistent with one of the specified patterns. Higher factor scores show greater consumption of food groups in the pattern and vice versa. The adequacy of data was evaluated based on the value of Kaiser-Meyer-Olkin and Bartlett's test. The Kaiser-Mayer-Olkin coefficient, which represents the adequacy of the sample size for factor analysis and should be greater than 0.5, was calculated and the obtained value was 0.743 in our study. The obtained dietary patterns scores are expressed as tertiles. The chi-square test was used to determine the significant differences between different categorical variable. The differences between mean were tested by independent samples t-test and one-way ANOVA. Moreover, the odds ratio (OR) and confidence interval (CI) for systolic and diastolic BP across tertiles categories of dietary pattern scores were tested by binary logistic regression. P value less than 0.05 was considered as statistically significant.

3. Results

A total of 765 patients with hypertension aged 30 to 64 years old (62.2% females, 37.8% males) were included in this study. The characteristics of the study population by sex are shown in Table 2. The results revealed that the mean age (years) for male patients was 54.78±7.2 vs. 55.49±6.9 for females. In addition, for the following factors (Educational level, employment history, family size, monthly income, history of smoking, physical activity level (Total MET), BMI (kg/m²), lipid abnormality or take medications for lipid abnormality, and HDL-c level), the difference was statistically significant in both sexes (P value < 0.05 for all). Then, the food consumption data for the 25 food groups (Table 1) were entered into the SPSS for factor analysis.

Table 1. *Food Groupings used in the Dietary Pattern Analysis.*

Food Groups	Food Items
Refined grains	White breads, toasted bread, cooked white rice, pasta (macaroni, spaghetti and the like)
Whole grains	Wheat bread, corn or canned, cooked cereals (as bulgur and the like)
Potatoes	Boiled potatoes
Beans and legumes	Cooked (lentils, chickpeas, black beans or white)
Red meat	(Beef, lamb), other meat (rabbit, duck), cold meats, hamburger
Organ meat	Beef liver or chicken liver, viscera (tripe, brains and the like)
Poultry	Chicken with skin, skinless chicken
Fish and shellfish products	Mixed fried fish, boiled or grilled fish (sardines, tuna), salted fish, canned water fish, canned fish in oil, (oysters, clams, mussels and the like), shellfish (shrimp and the like)
Fast foods	Meats as mortadella, sausage, pizza, pie
Eggs	Eggs
Low-fat dairy product	Skim milk, skimmed milk powder, yogurt
High-fat dairy products	Whole milk, (condensed milk, milk powder), cottage cheese curd or fresh white cheese, cream cheese or portions, ice cream, chocolate powder and the like, chocolate
Vegetables	Cooked spinach, (cabbage, cauliflower, broccoli), lettuce, onions, (carrots, pumpkin), cooked green beans, (eggplant, zucchini, cucumbers), mushrooms, canned vegetables, cooked green peas, garlic, pepper, (parsley, thyme, bay leaves, oregano, cilantro, mint and the like), avocado
Tomatoes	Tomatoes, tomato sauce (ketchup)
Fruit	Lemons, (oranges, grapefruit and the like), bananas, apple or pear, strawberries, (peach, apricot), fresh figs, (watermelon, cantaloupe, pineapple), papaya, grapes, mango, guava, kiwi, dried fruits (as raisins, prunes), fruits in syrup (juices of fruits, peach, pear, pineapple, fig)
Hydrogenated fats	Margarine, butter, mayonnaise
Vegetable oils	Corn oil, sunflower oil
Olive	Olives, olive oil
Nuts and seed products	Nuts (almonds, peanuts, hazelnuts, walnuts and the like), tahini (sesame seeds)
Sugar, sweets, and desserts	Biscuit, (croissant, pastries), shortbread, brownie, (custard, custard pudding), (jams, honey), sugar, tasty type artificial sweeteners
Snacks	Potato chips, bag of chips
Condiments	Spicy (pepper, chili)
Soft drinks	Soft drinks with sugar (as cola, orange, lemon, fanta and the like), low calorie soft drinks, fruit juice packaging
Beverages	Coffee, decaffeinated coffee, tea
Salt and pickles	Salt, pickles

Table 2. *Characteristics of the study population by sex.*

Variables		Hypertension (n=765)	Male (n=289)	Female (n=476)	P Value
		No. (%)	No. (%)	No. (%)	
Age (years)	Mean±SD	55.22±7.0	54.78±7.2	55.49±6.9	0.604
Marital status	Married	754 (98.6)	286 (37.9)	468 (62.1)	0.350
	Unmarried	11 (1.4)	3.0 (27.3)	8.0 (72.3)	
Educational level	Low education	451 (59.0)	140 (31.0)	311 (69)	0.001
	High education	314 (41.0)	149 (47.5)	165 (52.5)	
Employment history	Yes	82 (10.7)	62 (75.6)	20 (24.4)	0.001
	No	683 (89.3)	227 (33.3)	456 (66.7)	
Family size	Less than five	218 (28.5)	66 (30.3)	152 (69.7)	0.004
	Five or more	547 (71.5)	223 (40.8)	324 (59.2)	
Monthly income	≤ 2000 (NIS)	711 (92.9)	251 (35.3)	460 (64.7)	0.001
	> 2000 (NIS)	54 (7.1)	38 (70.4)	16 (29.6)	
History of smoking	Yes	97 (12.7)	96 (99.0)	1.0 (1.0)	0.001
	No	668 (87.3)	193 (28.9)	475 (71.1)	
History of alcohol intake	No	765 (100.0)	289 (37.8)	476 (62.2)	-
Physical activity (Total MET)	Mean±SD	808.1±1046	1005.0±1098	688.59±994.9	0.019
Insufficiently Active (MET/wk)	(≤ 600)	445 (58.2)	133 (29.9)	312 (70.1)	0.001
Sufficiently Active (MET/wk)	(601 to 1500)	214 (28.0)	102 (47.7)	112 (52.3)	0.001
Very Active (MET/wk)	(≥1500)	106 (13.9)	54 (50.9)	52 (49.1)	0.002
Body mass index (kg/m²)	Mean±SD	32.83±5.8	30.3±4.8	34.3±5.8	0.011
Normal weight (BMI: kg/m²)	(18.5 to 24.9)	54 (7.1)	40 (74.1)	14 (25.9)	
Overweight (BMI: kg/m²)	(25 to 30)	196 (25.6)	105 (53.6)	91 (46.4)	0.001
Obesity (BMI: kg/m²)	(> 30)	515 (67.3)	144 (28.0)	371 (72.0)	
Waist circumference (cm)	Mean±SD	112.7±13.6	107.9±12.8	115.6±13.3	0.157
Lipid abnormality or take medications for lipid abnormality	Yes	482 (63.0)	155 (32.2)	327 (67.8)	0.001
	No	283 (37.0)	134 (47.3)	149 (52.7)	
Triglycerides level (mg/dl)	Mean±SD	180.8±54.8	173.2±55.2	185.3±54.1	0.405
HDL-cholesterol level (mg/dl)	Mean±SD	41.86±7.5	39.9±6.3	43.0±8.0	0.001
Systolic BP (mmHg)	Mean±SD	139.8±7.5	138.9±7.1	140.4±7.7	0.297
Diastolic BP (mmHg)	Mean±SD	88.27±5.5	87.5±5.2	88.7±5.6	0.051
In this study, all patients had high BP (≥140/90 mmHg) or treatment of previously diagnosed hypertension					

Data are expressed as means ± SD for continuous variables and as percentage for categorical variables. The differences between means were tested by using independent sample t test. The chi-square test was used to examine differences in the prevalence of different categorical variable. P value less than 0.05 was considered as statistically significant. SD, stander deviation.

The scree plot of eigenvalues indicated two major patterns: 1) Asian-like pattern characterized by a high intake of whole grains, potatoes, vegetables, fruit and olive as well as a low intake of refined grains, sugar, sweets and desserts; 2) Sweet-soft drinks-snacks pattern characterized by a high intake of refined grains, sugar, sweets, desserts, snacks, soft drinks and beverage as well as a low intake of fruits. The factor loading matrixes for the two major patterns are shown in Table 3.

Table 3. *Factor loading matrix for major dietary patterns.*

Food Groups	Dietary patterns	
	Sweet-soft drinks-snacks pattern	Asian-like pattern
Refined grains	0.258	0.238
Whole grains	-	0.251
Potatoes	-	0.213
Beans and legumes	-	-
Red meat	-	-
Organ meat	-	-
Poultry	-	-
Fish and shellfish products	-	-
Fast foods	-	-
Eggs	-	-
Low-fat dairy product	-	-
High-fat dairy products	-	-
Vegetables	-	0.287
Tomatoes	-	-
Fruit	0.261	0.965
Hydrogenated fats	-	-
Vegetable oils	-	-
Olive	-	0.208
Nuts and seed products	-	-

Food Groups	Dietary patterns	
	Sweet-soft drinks-snacks pattern	Asian-like pattern
Sugar, sweets, and desserts	0.307	0.246
Snacks	0.245	-
Condiments	-	-
Soft drinks	0.999	-
Beverages	0.236	-
Salt and pickles	-	-
Variance explained (%)	26.024	60.021
Values less than 0.2 were omitted for simplicity. Total variance explained by two factors: 86.045		

These two major dietary patterns explained 60.0% and 26.0% of the total variance, respectively. In our study, the dietary patterns scores were classified as tertiles. Then, the characteristics of the study population were evaluated within the tertiles. Table 4 shows that patients in the lowest tertile (T1) of the Asian-like pattern were had a small family size (less than five) (31.7 vs. 34.4 %, P value < 0.005), had a lower BMI (32.6±5.9 vs. 33.1±5.5 kg/m², P value < 0.05), and had a lower lipid abnormality or take medications for lipid abnormality (33.8 vs. 34.7 %, P value < 0.05), compared to those in the highest tertile (T3). On the other hand, only the distribution of patients with regard to history of smoking and physical activity level (Total MET) was significantly different across the tertiles of the sweet-soft drinks-snacks pattern (P value < 0.05).

Table 4. *Characteristics and dietary intakes of study population by Tertile (T) categories of dietary pattern scores.*

Variables	Sweet-soft drinks-snacks pattern			P Value	Asian-like pattern			P Value
	T1	T2	T3		T1	T2	T3	
Age (years)								
Mean±SD	55.0±7.1	55.2±6.5	55.2±7.4	0.897	55.5±7.2	55.6±6.8	54.5±7.0	0.051
Gender %								
Males	32.1	32.9	35.0	0.585	36.3	29.1	34.6	0.855
Females	34.0	33.6	32.4		31.5	35.9	32.6	
Marital status %								
Married	33.4	33.3	33.3	0.532	33.3	33.4	33.3	0.726
Unmarried	27.2	36.4	36.4		36.4	27.2	36.4	
Educational level %								
Low education	36.6	30.4	33.0	0.923	32.1	33.7	34.2	0.133
High education	28.7	37.6	33.7		35.0	32.8	32.2	
Employment history %								
Yes	32.9	37.8	29.3	0.560	36.6	23.2	40.2	0.636
Family size %								
Less than five	32.1	33.0	34.9	0.062	31.7	33.9	34.4	0.005
Five or more	33.9	33.4	32.7		34.1	33.0	32.9	
Monthly income (NIS) %								
≤ 2000 (NIS)	32.9	33.5	33.6	0.769	34.0	33.8	32.2	0.916
> 2000 (NIS)	38.9	31.5	29.6		24.0	27.8	48.2	
History of smoking %								
Yes	36.0	28.9	35.1	0.039	34.0	30.9	35.1	0.545
Physical activity (Total MET)								
Mean±SD	815±1066	737±1046	871±1024	0.001	881±1224	819±922	723±962	0.195
Insufficiently Active (≤ 600 MET/wk)								
Yes	33.0	34.8	32.2	0.857	31.9	33.5	34.6	0.210
Sufficiently Active (601 to 1500 MET/wk)								
Yes	34.1	32.7	33.2	0.731	36.0	30.8	33.2	0.310
Very Active (≥ 1500 MET/wk)								
Yes	33.0	28.3	38.7	0.849	34.0	37.7	28.3	0.638
Body mass index (kg/m²)								
Mean±SD	33.6±6.0	32.3±5.2	32.4±6.0	0.591	32.6±5.9	32.6±5.9	33.1±5.5	0.044
Waist circumference (cm)								
Mean±SD	112.8±13	113.5±13	111.8±13	0.409	113.2±13	112.6±14	112.4±12	0.731
Lipid abnormality or take medications for lipid abnormality %								
Yes	33.4	35.0	31.5	0.200	33.8	31.5	34.7	0.021
Triglycerides level (mg/dl)								
Mean±SD	175.5±48	180.8±50	185.9±63	0.966	187.7±62	179.2±53	175.4±46	0.697
HDL-cholesterol level (mg/dl)								
Mean±SD	41.7±7.2	41.3±7.5	42.4±7.9	0.235	41.7±7.7	43.3±7.7	40.4±6.9	0.177

ANOVA test was used for quantitative variables and chi-square for qualitative variables. P value less than 0.05 was considered as statistically significant. SD, stander deviation.

Finally, the OR and CI for systolic and diastolic blood pressure across tertiles categories of dietary patterns scores were computed (Table 5). Our findings demonstrate that after adjustment for confounding variables, patients in the lowest tertile (T1) of the Asian-like pattern characterized by a high

intake of whole grains, potatoes, vegetables, fruit and olive had a lower odds for high systolic BP, (OR 0.970 CI 95% (.951-.990)), (P value < 0.05). No significant association was found between the Asian-like pattern with diastolic BP. In addition, no significant association was found between the sweet-soft drinks snacks pattern with systolic and diastolic BP.

Table 5. *Odd ratio and confidence interval for systolic and diastolic BP across tertiles categories of dietary pattern scores.*

Sweet-soft drinks-snacks pattern					**Asian-like pattern**				
T1	**T2**	**T3**	**P value**	**OR (95%CI)**	**T1**	**T2**	**T3**	**P value**	**OR (95%CI)**
Systolic BP (≥140 mmHg)									
33.6	33.6	32.8	0.593	0.957 (.816-1.123)	34.5	33.2	32.3	0.082	0.958 (.913-1.005)
Adjusted*			0.699	0.966 (.811-1.151)	Adjusted*			0.003	0.970 (0.951-.990)
Diastolic BP (≥90 mmHg)									
33.2	33.0	33.8	0.879	0.987 (.831-1.172)	33.7	33.7	32.6	0.561	0.950 (.799-1.130)
Adjusted*			0.961	0.995 (.827-1.198)	Adjusted*			0.252	1.117 (.923-1.351)

The OR and CI for systolic BP (≥140 mmHg), and diastolic BP (≥90 mmHg) across tertiles categories of dietary pattern scores were tested by binary logistic regression. *Adjusted for age, gender, marital status, educational level, employment history, family size, monthly income, history of smoking, physical activity (Total MET), BMI (kg/m²), WC (cm), lipid abnormality or take medications for lipid abnormality, TGs level (mg/dl) and HDL-c level (mg/dl). P value less than 0.05 was considered as statistically significant. OR, odds ratio; CI, confidence interval.

4. Discussion

Cardiovascular diseases are the main leading cause of death among Palestinian adults, with high BP being a major determining factor [4-8]. Our study was conducted to determine the associations between major dietary patterns and BP control among hypertensive patients in Gaza Strip, Palestine. In this study, all participants had high BP (≥140/90 mmHg) or treatment of previously diagnosed hypertension. To our knowledge, this is the first investigation reporting such an association among hypertensive patients in Gaza Strip, Palestine. In our study, two major dietary patterns were identified by factor analysis. 1) Asian-like pattern characterized by a high intake of whole grains, potatoes, vegetables, fruit and olive as well as a low intake of refined grains, sugar, sweets and desserts; 2) Sweet-soft drinks-snacks pattern characterized by a high intake of refined grains, sugar, sweets, desserts, snacks, soft drinks and beverage as well as a low intake of fruits. Our study findings showed that after adjustment for confounding variables, the Asian-like pattern may be associated with a lower prevalence of systolic BP among hypertensive patients. The dietary pattern approach reflects individuals dietary behaviors and therefore can provide more detailed information about nutritional etiology of chronic diseases [9-11]. Ndanuko et al. [34] in a meta-analysis identified three dietary patterns: Healthy dietary patterns such as the Dietary Approaches to Stop Hypertension (DASH) diet, Nordic diet and Mediterranean diet. These dietary patterns are rich in fruit, vegetables, whole grains, legumes, seeds, nuts, fish and dairy. The author concluded that these dietary patterns were inversely associated with high BP. The results of our study support these findings. The DASH dietary pattern is rich in fruits and vegetables, low fat dairy products, whole grains, fish, poultry, beans, seeds and nuts. It is low in sodium, added sugars, sweets, fats and red meats. The DASH dietary pattern is a recognized treatment for hypertension, stroke and heart disease [35]. Nilofer et al. [36] identified three dietary patterns among Pakistani low-income urban adults. The author concluded that the seafood and yogurt pattern (Characterized by fish, prawns, potatoes and yogurt) was less likely to be associated with hypertension, whereas no significant associations were seen for other two dietary patterns. Dong et al. [37] identified three major dietary patterns: Western, traditional northern and traditional southern. The author concluded that the traditional southern pattern (Characterized by high intakes of fruit, pork, poultry, rice, vegetables, aquatic products and nuts) was associated with lower prevalence of hypertension among Chinese adults. Ji-Ye Shin et al. [38] identified three major dietary patterns: traditional, western, and dairy and carbohydrate patterns. The author concluded that the dairy and carbohydrate pattern may be associated with a reduced risk of hypertension whereas the western pattern may be associated with an increased risk of hypertension among Korean adults. The previous dietary patterns are different from those obtained in our study. This can be explained by demographic, cultural and ethnic differences.

On the other hand, our findings show that patients in the lowest tertile (T1) of the Asian-like pattern were had a small family size (less than five), had a lower BMI, and had a lower lipid abnormality or take medications for lipid abnormality, compared to those in the highest tertile (T3). According to the DASH, diets high in fruits, vegetables and low in fat may be associated with a lower risk of hypertension, decreased weight, BMI, serum triglycerides, and very low density lipoprotein cholesterol levels [39-40]. The results of our study support these findings. In our study, the inverse association between Asian-like pattern with high systolic BP could be attributed to pattern's healthy ingredients including vitamins, dietary fibers, potassium, magnesium and antioxidants. These nutrients have been independently associated with reduced risks of high BP [41]. In our study, the Asian-like pattern has been shown to be the healthiest dietary pattern and is quite close to that diet, which generally recommended as a healthy dietary pattern with low intake of sodium, animal foods, saturated fat, trans fat, cholesterol and simple sugar, which may be associated with a higher risks of hypertension and its complications [42]. On

contrary, no significant association was found between the Asian-like pattern with diastolic BP. Our study not adjusted for other confounding variables such as genetics factors, types of antihypertensive drugs and psychological factors, which could contribute to these results. The main limitations of this study is its cross sectional design; the causal relationship could not be determined. Moreover, the possibility of recall bias and misreporting by using FFQ assessment of dietary patterns are other limitations. Furthermore, regrettably we do not have tests of total cholesterol, and low-density lipoprotein cholesterol as a marker of BP control. The main strength of our study was its being the first study, which identified the major dietary patterns among hypertensive patients in Gaza Strip, Palestine, and its large sample size.

5. Conclusions

In conclusion, the Asian-like pattern characterized by a high consumption of whole grains, potatoes, vegetables, fruit and olive may be associated with a lower prevalence of systolic blood pressure among hypertensive patients. Further future studies are required to confirm these findings.

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