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Research Article

Association Of Dietary Pattern With Systolic And Diastolic Blood Pressure In Young Adults Of Punjab, Pakistan

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Abstract

Background: Hypertension, a complex metabolic disorder, involves various hormonal and biochemical mechanisms. Many risk factors are reported to be associated with hypertension. Increase in urbanization, unhealthy diet, and obesity are affecting the population in Pakistan as they have globally in the last decade.

Objectives: This study was planned to assess the dietary patterns in young adults and to find association with systolic and diastolic blood pressure.

Material and Methods: This cross-sectional study was approved by the board of studies and the ethical review committee, Institute of Molecular Biology and Biotechnology (IMBB), The University of Lahore. A total of 589 young adults of 18-23 years studying in different institutes participated in the study. Written consent was obtained from each participant. A standardized questionnaire was used to collect information like name, age, gender, dietary pattern, blood pressure, and family history of hypertension. The data recorded from all participants were entered into a standardized proforma.

Results: A total of 589 subjects were divided based on blood pressure values into three groups: normotensive, prehypertensive, and hypertensive. Both male and female subjects participated in the study. The subjects were divided into healthy, borderline and unhealthy dietary patterns based on dietary habits. Among these, sixty subjects had systolic prehypertension, and eight had hypertension based on systolic blood pressure. The diastolic type of prehypertension was observed in forty subjects, while the diastolic type of hypertension was seen in nineteen subjects. Significant difference of systolic blood pressure was observed within hypertensive group based on dietary pattern. The present study found a strong association between dietary pattern, systolic and diastolic blood pressure.

Statistical Analysis: It was performed by SPSS. For comparison within the groups, ANOVA and independent t test was used.

Conclusion: In this study, systolic and diastolic blood pressure revealed strong association with unhealthy dietary patterns. Strategies to minimize risk of hypertension may be adopted by increasing awareness about importance healthy diet.

Key words: Hypertension, Prehypertension, Dietary pattern, Young adults, Systolic blood pressure, Unhealthy diet

1 Introduction

Hypertension is a chronic disease affecting a large proportion globally. It is a concerning issue for developed and underdeveloped countries. Hypertension is a grave health issue that is directly associated with heart, brain, and kidney diseases (Fisher and Curfman, 2018). Approximately 1.4 billion individuals globally have high arterial pressure. About 32.9% of young people in the US had blood pressure >140/90 mm Hg or were taking treatment for high blood pressure as documented by The National Health and Nutrition Examination Survey (2017-2020). An estimated 21% of individuals among these adults are unaware of having hypertension. The frequency of ischemic heart disease, cerebrovascular complications, and heart failure is 25% to 50% among hypertensive patients (Heaton *et al*., 2024). The incidence is similar in European countries (Ji *et al*., 2020). The increase is observed more in the middle and low-income countries. Key regulators of the blood pressure are sympathetic nervous system and the renin-angiotensin-aldosterone system (Sohail *et al*., 2024). Many risk factors are associated with the development and pathogenesis of hypertension. In the low-income countries, the major causes of steadily increasing prevalence and uncontrolled blood pressure include rapid urbanization, lifestyle changes, aging population, environmental factors, and the little knowledge of the disease (Mishra,

2022). The prevalence of hypertension is higher in urban areas as compared to rural areas (Shafi and Shafi, 2017). The knowledge, health facilities, and community awareness about the disease are not up to the mark (Riaz *et al*., 2021).

Dietary habits are a well-established risk factor related to high blood pressure. Rapid urbanization is the major cause of dietary shift from natural to processed food. Diets rich in sodium, fats, and processed food can lead to hypertension. Studies have shown that modulation of diet has a direct impact on blood pressure and reduces the risk of hypertension (Ndanuko *et al*., 2016). Non-adherence to a healthy diet is a major issue associated with the pathogenesis of hypertension. Red meat, salt, and added sugars also revealed a link with hypertension. Unhealthy dietary patterns are often characterized by an imbalance of macronutrients and micronutrients, leading to weight gain, inflammation, and impaired vascular function and development of hypertension (Tang *et al*., 2021).

It is concerning that gradually young adults are also being affected by the hypertension in Pakistan. The young adult population is overlooked with a misunderstanding that this age is not generally vulnerable to develop hypertension. This study is planned to investigate dietary patterns in young adults of Punjab, Pakistan and its association with prehypertension and hypertension among young adults.

2 Methods

2.1 Study Aims: The study was designed to evaluate the association of the dietary patterns with systolic and diastolic blood pressure in young adults.

2.2 Study Participants: This study was approved by the board of studies and the ethical review committee, Institute of Molecular Biology and Biotechnology (IMBB), The University of Lahore. A total of 589 young adults of 18-23 years studying in different institutes participated in the study. Written consent was obtained from each participant. A standardized questionnaire was used to collect information like name, age, gender, dietary pattern, blood pressure, and family history of hypertension. The data recorded from all participants were entered into a standardized proforma. Subjects were divided based on blood pressure values into three groups: group A (normotensive), group B (prehypertensive), and group C (hypertensive).

2.3 Inclusion Criteria: Young adults residing in Punjab, Pakistan, were included in the present study. Physically and mentally fit subjects were enrolled in the study.

2.4 Exclusion Criteria: Subjects below 16 years and above 23 years of age, physically unfit, and using antihypertensive medication were excluded from the study. The subjects with a history of any chronic disease, like diabetes mellitus, were also excluded from the study.

2.5 Blood Pressure Measurement

Blood pressure was measured using a mercury sphygmomanometer in a sitting position in a comfortable environment. Three readings were taken from each participant at fifteen-minute intervals. The average of the three measurements was calculated as the final blood pressure. Subjects were labelled prehypertensive if they had systolic blood pressure between 120-139 mmHg and diastolic pressure in the range 80-89 mmHg. Hypertension was established as if they had a systolic BP ≥ 140 mmHg and a diastolic BP ≥ 90 mmHg (Muntner *et al*., 2018).

2.6 Dietary intake assessment

Dietary intake was assessed by a food frequency questionnaire (FFQ). FFQ was modified according to Punjab, Pakistan food culture. Description of food intake and dietary pattern was assessed by a detailed interview based on 72-hour recall. The nutritional content and energy content of each food consumed were assessed by a standardized method (Dabbagh *et al*., 2018). Subjects were included in the borderline category if they consumed a moderate quantity of a healthy diet, occasional use of processed food, fried foods, and sugary drinks. The unhealthy dietary pattern included processed and fast foods, red meats, fried foods, high saturated diet, and salty foods.

2.7 Data Analysis

It was performed by SPSS version 24. Blood pressure values were presented as mean ± SEM (standard error of mean). Comparison within groups was determined by using student *t* test (between two groups) and ANOVA (between three or more groups). Associations were analyzed by Chi Square test.

3 Results

A total of 589 young adults between 16-22 years of age were enrolled and investigated for demographic, anthropometric, sports activity, and dietary patterns in the study. The age of these subjects ranged between 19 and 21 years. Out of these young adults, three hundred and twenty (55.17%) were male and 264 (44.82%) were female. All the subjects were students studying in different programs of the university from Lahore and other cities of the Punjab, Pakistan. Family history of hypertension was positive in 37.3% of subjects (20% males and 17.3% females). Four hundred and ninety subjects (83.19%) were consuming a healthy, balanced diet compared to eighty-one (13.75%) and eighteen (3%) subjects who were consuming borderline and unbalanced diets, respectively, among all study participants (Table 1).

Table 1: Demographic and phenotypic characteristics of the study subjects

Variables	Characteristics

Total Number of Subjects		589
Age		19-21 years
Gender	Male	325 (55.17%)
	Female	264 (44.82%)
Profession		Students of the university and college
Region		Lahore and different cities of the Punjab, Pakistan
Family History of Hypertension		Positive in 37.3% of subjects Males: 118 (20%) Females: 102 (17.3%)
BMI	Underweight	83 (14.1%)
	Normal	329 (55.85%)
	Overweight	147 (24.95%)
	Obese	30 (5%)
Dietary Pattern	Healthy	490 (83.19%)
	Borderline	81 (13.75%)
	Unhealthy	18 (3%)

Table 2 summarizes that 521(88.45%) subjects were normotensive, while 10.2% and 1.3% of young adults had prehypertension and hypertension based on systolic pressure. Similarly, 90% of subjects had normal diastolic blood pressure, 6.8% and 3.2% had diastolic pressure in the prehypertensive and hypertensive range. Table 3 summarizes the frequency and percentages of the normotensive, prehypertensive and hypertensive subjects according to systolic and diastolic blood pressure based on gender and dietary.

Table 2: Frequency distribution of subjects based on systolic and diastolic blood pressure

Variable	Groups		
	Normotensive	**Prehypertensive**	**Hypertensive**
Systolic BP	521 (88.45%)	60 (10.2%)	8 (1.3%)
Diastolic BP	530 (90%)	40 (6.8%)	19 (3.2%)

Table 3: Frequency distribution of blood pressure categories based on gender and dietary Pattern according to systolic pressure

Systolic Blood Pressure				
		Normotensive (%)	**Prehypertensive (%)**	**Hypertensive (%)**
Gender	**Male (325)**	276 (84.9%)	46 (14.2%)	3 (0.9%)
	Female (264)	245 (92.8%)	14 (5.3%)	5 (1.9%)
Dietary Pattern	**Healthy (490)**	468 (95.5%)	22 (4.5%)	0 (0%)
	Borderline (81)	51 (63.0%)	26 (32.1%)	4 (4.9%)
	Unhealthy (18)	2 (11.1 %)	12 (66.7%)	4 (22.2%)
Diastolic blood pressure				
Gender	**Male (325)**	279 (85.8%)	32 (9.8%)	14 (4.3%)
	Female (264)	251 (95.1%)	8 (3.0%)	5 (1.9%)
Dietary Pattern	**Healthy (490)**	476 (97.1%)	13 (2.7%)	1 (0.2%)
	Borderline (81)	51 (63.0%)	18 (22.2%)	12 (14.8%)
	Unhealthy (18)	3 (16.7%)	9 (50.0%)	6 (33.3%)

Significant difference in systolic blood pressure was observed between males and females within the normotensive, prehypertensive, and hypertensive groups. Similarly, the difference in diastolic pressure was found statistically significant between male and female subjects within the normotensive, prehypertensive, and hypertensive subjects. Subjects consuming healthy, borderline, and unhealthy diets showed no difference in systolic blood pressure within normotensive (p value 0.254) and prehypertensive groups (p value 0.233). Differences within the hypertensive group were found to be statistically significant with a p-value <0.05. The difference in diastolic blood pressure was non-significant based on dietary pattern within the normotensive, prehypertensive, and hypertensive groups (Table 4).

Table 5 showed strong association of gender with both systolic and diastolic blood pressure. The analysis revealed a strong association between

dietary pattern and systolic blood pressure ($\chi 2$ = 203.02, P value < 0.05). Likewise, the Chi-square analysis revealed a strong association between dietary pattern and diastolic blood pressure ($\chi 2$ =208.53, P < 0.001) as described in Table 5.

Table 4: Comparison of systolic and diastolic blood pressure based on gender and dietary pattern within normotensive, prehypertensive, and hypertensive subjects

Systolic Blood Pressure							
Parameter		Normotensive		Prehypertensive		Hypertensive	
		Mean± S.E	p-Value	Mean± S.E	p-Value	Mean± S.E	p-Value
Gender	Male	113.0±0.4	0.000	130.4±0.6	0.000	141.3±1.3	0.000
	Female	110.8±0.5		129.0±1.3		142.0±2.0	
Dietary Pattern	Healthy	111.9±0.3	0.254	131.2±1.1	0.233	-	0.000
	Borderline	112.6±1.2		129.7±.6		140	
	Unhealthy	120.0±0.0		128.8±1.21		143.5±2.3	
Diastolic Blood Pressure							
Parameter		Normotensive		Prehypertensive		Hypertensive	
		Mean± S.E	p-Value	Mean± S.E	p-Value	Mean± S.E	p-Value
Gender	Male	73.04±.445	0.000	86.0±.271	0.000	92.71±1.121	0.000
	Female	71.67±.478		86.7±.526		98.0±2.0	
Dietary Pattern	Healthy	72.38±.338	0.602	86.4±.462	0.699	90.0±0.0	0.111
	Borderline	72.16±1.238		86.2±.319		92.8±1.290	
	Unhealthy	76.67±3.333		85.9±.588		97.3±1.764	

Table 5: Association of gender and dietary patterns with systolic and diastolic blood pressure

Parameter	**Systolic Blood Pressure**		**Diastolic Blood Pressure**	
	Chi square (χ^2)	p-Value	Chi square (χ^2)	p-Value
Gender	13.23	.000	13.97	.000
Dietary Pattern	203.02	.001	208.53	.000

4 DISCUSSION

Hypertension is a global issue, and affects more than a billion people worldwide. The gravity of the disease is more worrying for the South Asian countries like Pakistan (Neupane et al., 2014). Hypertension is accounting for approximately ten million deaths every year. Such a high mortality rate is because of uncontrolled hypertension despite the availability of drugs and their good drug tolerance (Roger et al., 2012). The exact etiology of hypertension is not known. In 95% of the cases of hypertension, pathogenic mechanisms are unclear (Livingstone and McNaughton, 2016). Several modifiable risk factors are the reason for high mortality worldwide. These factors include obesity, a sedentary lifestyle, and an unbalanced diet. Unhealthy dietary patterns are the major cause of obesity and high blood pressure worldwide (Cherfan et al., 2020).

The current study found that 13.75% of subjects were consuming more food than required. The unhealthy dietary patterns were observed in 3% of young adults. A high prevalence of hypertension was observed in subjects consuming an unbalanced diet. Significant difference of the systolic blood pressure based on dietary pattern was observed within the hypertensive group. The difference in diastolic pressure within the normotensive, prehypertensive, and hypertensive based on dietary patterns showed no significant difference. The present study indicated a strong association of dietary patterns with systolic and diastolic pressure.

Similar to the current study, unhealthy diets revealed a strong association with hypertension (Margerison et al., 2020). Dietary patterns are changing in the underdeveloped countries due to the increased rural-to-urban shift in low-income countries (Kamran et al., 2016). The use of natural and raw food is decreasing, and the consumption of processed food is increasing in underdeveloped countries (Wong et al., 2020).

The consumption of saturated fat, low fiber and high salt in diet demonstrated significant relation with the risk of hypertension in the Australian population (Bell et al., 2015). Moreover, the diet rich in flavonoids showed antihypertensive effects. Exact mechanism of this association is not fully understood

but it is proposed that they suppress production of reactive oxygen species. (Kong et al., 2023). Because of strong association of dietary pattern with hypertension, healthy diet plan (DASH Diet) was proposed in an attempt to reduce the risk of hypertension worldwide (Feyh et al., 2016). Non-adherence to healthy diet is the major issue associated with the pathogenesis of hypertension. Strict adherence to the DASH diet reduced both systolic and diastolic pressures in prehypertensive and hypertensive groups (Lin et al., 2012; Tyson et al., 2012). Results of the study conducted in uncontrolled hypertensive patients showed that good adherence to DASH plan with daily walk led to a decrease in the blood pressure (Paula et al., 2015). Many studies had negated the association between dietary habits and blood pressure. Recent study demonstrated no association between risk of hypertension and change in dietary habits (Chen et al., 2023). Consumption of fruits and vegetables also failed to prove relation between hypertension and dietary pattern in Pakistani population (Safdar et al., 2013). Investigation in the Chinese population also failed to prove any link between diet and hypertension (Yang et al., 2022).

4.1 Study Limitations: It is the small sample size.
4.2 Strength of the study: Hypertension is a chronic metabolic disease and is affecting due to rapid change in dietary patterns. The younger population is also being affected gradually. This study describe the association of the dietary patterns with systolic and diastolic blood pressure.
4.3 Future Recommendations: It is reasonable to postulate that healthy dietary patterns can reduce the burden and risk of developing hypertension in young population.
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