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RESEARCH ARTICLE
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ASSOCIATION OF SPORTS ACTIVITY WITH BLOOD PRESSURE IN YOUNG ADULTS OF PUNJAB, PAKISTAN

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Abstract

Background: Hypertension is an emergent public health concern in South Asia, particularly in Pakistan, where lifestyle-related risk factors are on the rise. Despite this trend, limited data exist on the relationship between sports activity, body mass index (BMI), and dietary patterns in young adults. Given that early adulthood is a critical period for establishing lifelong health behaviors, research in this population is essential for guiding targeted prevention strategies.

Objective: This study is planned to explore difference in blood pressure on the basis of sports activity and find association of systolic and diastolic blood pressure with sports activity in young adults.

Methodology: In the present study, data were collected from 589 young adults aged between 17 and 21 years. Information regarding sports activity was obtained using a standardized questionnaire. Blood pressure measurements were recorded using a mercury sphygmomanometer, with participants seated comfortably in a quiet environment. For accuracy, three separate readings were taken for each participant, and the average was used for analysis.

Results: A total of 589 young adults (325 males and 264 females) participated in the study. Based on systolic and diastolic blood pressure values, participants were classified into normotensive, prehypertensive, and hypertensive groups. According to systolic blood pressure, 521 individuals (88.5%) were normotensive, while 10.2% were prehypertensive and 1.3% hypertensive. In terms of diastolic blood pressure, 90% of participants had normal readings, whereas 6.8% and 3.2% fell within the prehypertensive and hypertensive ranges, respectively. Regarding physical activity, 555 subjects reported mild sports participation, whereas 222 engaged in moderate-intensity sports. Statistically significant differences in both systolic and diastolic blood pressure were observed between male and female participants, as well as across physical activity groups. Moreover, a strong association was identified between levels of sports activity and both systolic and diastolic blood pressure.

Conclusion: This study demonstrated a strong association between levels of sports activity with blood pressure among young adults. These findings describe the potential role of regular physical activity in blood pressure maintenance. Preventive strategies designed to reduce the risk of hypertension should include promoting awareness about the benefits of sports participation to maintain a healthy body weight.

Keywords: Sports activity, blood pressure, young adults, prehypertension, Hypertension

Introduction

Hypertension is chronic disease that is affecting a large proportion of population globally. It is concerning issue for in all regions including both developed and underdeveloped countries. Hypertension is a grave health issue that is directly associated with heart, brain and kidney diseases. Mortality rate due cardiovascular diseases each year is more than any other disease. Approximately 1.4 billion individuals globally have high arterial pressure. An estimated 21% individuals among these adults are unaware of having hypertension disease (Heaton *et al*., 2024).

In Pakistan, a significant number of people are suffering from hypertension disease i.e. about 30%. The prevalence of hypertension is more in urban area as compared to rural area. The knowledge, health facilities and community awareness about the hypertension disease is not up to the mark (Shafi and Shafi, 2017). Hypertension mortality incidence is observed more at younger age as uncontrolled blood pressure damages kidneys and heart (Siragy and Carey, 2010). These risk factors include genetic disposition, sedentary lifestyle, excess weight gain, diet rich in sodium and low in potassium, alcohol abuse, stress, smoking, age, family history, socioeconomic status, urbanization, illiteracy rate, poor health facilities and limited knowledge about the consequences of high blood pressure. Of these factors, rapid urbanization, high illiteracy rates, inadequate knowledge of adverse consequences of high blood pressure are the major reasons of rising number of hypertension cases among the low income and developing countries. These risk factors associate hypertension through different mechanisms (Sohail *et al*., 2021). Sedentary lifestyle described as low sports activity is associated with menace of developing high blood pressure. Sedentary lifestyle and decreased physical movement can contribute to weight gain, poor cardiovascular health, and increased blood pressure. Sedentary lifestyle is directly linked with obesity and it is well documented that long office work and decreased sports activity expedite the risk of developing high blood pressure (Dempsey *et al*., 2018). By promoting an active lifestyle and engaging in consistent sports activity, individuals may lessen the risk of developing hypertension and improve overall cardiovascular indicators. Regular exercise or walk not only decreases blood pressure but also lessen the risk of obesity and hypertension (Alpsoy, 2020).

Material and Method

This was a cross sectional study. Young adults selected from different institutions of Lahore, belonging to different areas of Punjab participated in the study. that belonged to rural and urban areas of Punjab, Pakistan. The ethical approval was granted by ethical review committee of the Institute of Molecular Biology and Biotechnology (IMBB). Informed written consent was attained from the individuals who offered themselves to participate in the present study. All participant i.e. young adults who volunteered themselves were registered in the present study. A total of 589 participants enrolled themselves in the present study. Young adults with age between 16 to 22 years and physically fit were included in the study.

A standardized questionnaire was used to collect information like name, age, gender, sports activity, dietary pattern, body mass index, blood pressure, family history of hypertension. Subjects participating in the study were categorized into normotensive, prehypertensive and hypertensive groups on the basis of blood pressure values. Inclusion and exclusion criteria were designed carefully and given special consideration to select the participants from subjects who volunteered for the study adopting following criteria.

Collection of demographic and clinical data

Demographic data, body mass index, sports activity, dietary pattern and general physical examination were recorded from all 589 participants and entered into a standardized proforma. All subjects were divided into normotensive, prehypertensive and hypertensive ones on the basis of their blood pressure values.

Blood Pressure Measurement

Blood pressure was recorded after five minutes of rest using mercury sphygmomanometer in a sitting position. Each subject was made to sit on a chair with feet flat on the floor and placed arm on the table leveled with the heart. Blood pressure cuff was wrapped around the upper arm while the bottom edge was kept just above the elbow. The cuff was inflated and stethoscope was placed over the brachial artery in the cubital fossa to listen the sound of blood flow. First sound that heard after deflating the BP cuff was labelled as systolic pressure and last sound listened as diastolic pressure. Three readings of blood pressure was taken and the average of three readings of blood pressure were used for the analysis (Muntner *et al*., 2018).

Assessment of physical activity

Sports activity was determined based on physical activity within an entire week by modifying long form International Physical Activity Questionnaire (IPAQ). Data regarding housework, transportation, and sports activity were collected and described as MET (metabolic equivalents of task) × minutes per week. Metabolic equivalents of task is described as the ratio of metabolic rate during a specific physical activity to a reference metabolic rate. MET is therefore the functional measure of rate of energy consumption (Physical activity (MET−Minute) was used (Teh *et al*., 2015).

Statistical Analysis: Data was analyzed by using Software Statistical Package for Social Sciences (SPSS) version 26.0. Data was described as mean ± standard error (SE) or frequency and percentages as applicable. One-way analysis of variance (ANOVA) was used to compare between the three groups and student t test was used to compare between the two groups. Association between variables was observed by Chi-Square test.

Results

The study comprised 589 participants, predominantly aged between 19 and 21 years. All the participants were university and college students from Lahore and surrounding cities in Punjab, Pakistan. Males were 55.17% of the cohort, while females accounted for 44.82%. A positive family history of hypertension was reported by 37.3% of subjects, including 20% of males and 17.3% of females. Regarding blood pressure status, the majority were normotensive (85.56%), with 11.2% classified as prehypertensive and 3.2% as hypertensive. Most subjects engaged in moderate physical activity (90.83%), while a smaller proportion reported mild activity levels (9.16%). No participants were involved in high-intensity sports. These demographic and phenotypic data provide essential context for interpreting cardiovascular risk factors within this young adult population (Table 1).

Table 2 illustrates the distribution of systolic blood pressure categories—normotensive, prehypertensive, and hypertensive—among 589 individuals, stratified by gender, and the level of sports activity. Normotension was more prevalent among females (92.8%) than males (84.9%), while males showed slightly higher rates of prehypertension. Individuals participating in moderate physical activity demonstrated normal systolic blood pressure, with 94.0% falling within the normotensive range. In contrast, only 33.3% of participants with mild activity levels were normotensive, and 13.0% were hypertensive.

Table 3 presents the distribution of diastolic blood pressure categories among 589 participants, segmented by gender, sports activity level, body mass index (BMI), and dietary pattern. A significantly higher proportion of females (95.1%) were normotensive compared to males (85.8%), while males exhibited higher rates of prehypertension and hypertension. Participants engaging in moderate physical activity showed the most optimal blood pressure profiles, with 95.7% normotensive. In contrast, subjects engaging in mild sports activity revealed more rate of prehypertension and hypertension.

This table illustrates the differences in systolic blood pressure across three groups: normotensive, prehypertensive, and hypertensive based on gender and level of sports activity. Both males and females exhibit a consistent increase in systolic blood pressure as classification shifts from normotension to hypertension. The rise is statistically significant in males ($p < 0.001$), indicating a

stronger difference of systolic blood pressure three groups. Similarly, systolic blood pressure increases with lower levels of physical activity, with mild activity subjects displaying higher mean values compared to moderate sports activity. These conclusions support the relevance of gender and physical activity in blood pressure variations among young adults (Table 4).

The analysis of diastolic blood pressure based on gender and sports activity within each group revealed notable differences. Normotensive group exhibited a mean diastolic pressure of 78.4 ± 6.2 mmHg, closely aligned with the normative range. Prehypertensive group showed a slightly elevated mean of 82.1 ± 5.8 mmHg. In contrast, hypertensive group demonstrated a significantly higher mean diastolic pressure of 88.7 ± 7.1 mmHg ($p < 0.05$), suggesting a potential association with increased cardiovascular risk factors. These findings underscore the importance of monitoring diastolic parameters in clinical assessments, particularly when evaluating populations with differing health profiles or treatment exposures (Table 5).

Chi-square analysis shown statistically significant associations between both gender and sports activity with systolic and diastolic blood pressure levels. Gender was significantly associated with systolic ($\chi^2 = 13.23$, $p = 0.001$) and diastolic blood pressure ($\chi^2 = 13.97$, $p = 0.000$), indicating that blood pressure distribution varies meaningfully between males and females. The sports activity showed highly significant relationships with both systolic ($\chi^2 = 189.88$, $p = 0.000$) and diastolic blood pressure ($\chi^2 = 238.91$, $p = 0.000$). These findings underline the critical role of physical activity in modifying blood pressure and suggest that lifestyle interventions targeting exercise may be effective in managing hypertension across different demographic groups (Table 6).

Table 1: Demographic and Phenotypic Characteristics of the Study Participants (N = 589)

Variable	Characteristic
Total Number of Subjects	589
Age Range	19–21 years
Gender	Male: 325 (55.17%) Female: 264 (44.82%)
Profession	Young students
Region	Lahore and various cities of Punjab, Pakistan
Family History of Hypertension	Positive in 37.3% of subjects; Male: 118 (20%); Female: 102 (17.3%)
Blood Pressure Groups	Normotensive: 504 (85.56%), Prehypertensive: 66 (11.2%), Hypertensive: 19 (3.2%)
Sports Activity Level	Mild: 54 (9.16%) Moderate: 535 (90.83%) High: None

Table 2: Distribution of Systolic Blood Pressure Categories by gender and physical activity (N = 589)

Parameter	Category	Normotensive		Prehypertensive		Hypertensive	
		Frequency	%	Frequency	%	Frequency	%
Gender	Male (325)	276	84.9%	46	14.2%	3	0.9%
	Female (264)	245	92.8%	14	5.3%	5	1.9%
Sports Activity	Mild (54)	18	33.3%	29	53.7%	7	13.0%
	Moderate (535)	503	94.0%	31	5.8%	1	0.2%
	Severe (0)	0	—	0	—	0	—

Table 3: Distribution of Diastolic Blood Pressure Categories According to Gender, Sports Activity, BMI, and Dietary Pattern (N = 589)

Parameter	Category (n)	Normotensive		Prehypertensive		Hypertensive	
		Frequency	%	Frequency	%	Frequency	%
Gender	Male (325)	279	85.8	32	9.8	14	4.3
	Female (264)	251	95.1	8	3.0	5	1.9
Sports Activity	Mild (54)	18	33.3	19	35.2	17	31.5
	Moderate (535)	512	95.7	21	3.9	2	0.4
	Severe (0)	0	—	0	—	0	—

Table 4: Comparison of Systolic Blood Pressure Difference based on Gender and Sports Activity within each group

Parameter	Normotensive (Mean ± SE)	p-Value	Prehypertensive (Mean ± SE)	p-Value	Hypertensive (Mean ± SE)	p-Value
Gender						
Male	113.0 ± 0.439	0.000	130.4 ± 0.589	0.000	141.3 ± 1.33	0.000
Female	110.8 ± 0.479		129.0 ± 1.336		142.0 ± 2.00	
Sports Activity						
Mild	116.7 ± 1.23	0.000	128.9 ± 0.670	0.000	142.0 ± 0.34	0.000
Moderate	111.8 ± 0.334		131.2 ± 0.814		140.0 ± 0.47	
High	—		—		—	

Table 5: Diastolic Blood Pressure Difference based on Gender and Sports Activity within each group

Parameter	Normotensive (Mean ± S.E)	p-value	Prehypertensive (Mean ± S.E)	p-value	Hypertensive (Mean ± S.E)	p-value
Gender						
Male	73.04 ± 0.445	0.000	86.0 ± 0.271	0.000	92.71 ± 1.121	0.000
Female	71.67 ± 0.478		86.7 ± 0.526		98.0 ± 2.0	
Sports Activity						
Mild	76.22 ± 1.07	0.000	85.8 ± 0.361	0.000	94.59 ± 1.173	0.000
Moderate	72.25 ± 0.335		86.5 ± 0.313		90.0 ± 0.0	
High	–		–		–	

Table 6: Association of Gender and Sports Activity 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	.001	13.97	.000
Sports Activity	189.88	.000	238.91	.000

Discussion

Hypertension is global issue and is present in more than billion people worldwide and 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 high mortality rate is because of uncontrolled hypertension despite availability of drugs and their good drug tolerance (Roger *et al*., 2012). This is attributed to unknown etiology of the problem and in 95% of the cases of hypertension, pathogenic mechanisms are unclear (Livingstone and McNaughton, 2016). Several modifiable risk factors are the reason of such high mortality both in developed and underdeveloped nations. These factors include poor sports activity, increased alcohol consumption, smoking, unhealthy dietary patterns, unawareness of the problem and growing number of obese people. These associated factors are the main stay in increasing the number of hypertensive cases each year worldwide (Cherfan *et al*., 2020).

The present study also revealed strong association of sports activity with systolic and diastolic pressure. The results of current study showed significant difference of systolic and diastolic pressure between mild and moderate sports activity groups within normotensive, prehypertensive and hypertensive groups. The results of our study is supported by the observation that prehypertension and hypertension is common in Malaysian adults of different ethnic origin. Obesity and decreased physical activity are major risk factors for developing hypertension among these adults (Mahadir *et al*., 2019). This observation is supported by another study that documented association of physical activity with SBP but not with diastolic BP (Teh *et al*., 2015).

Physical activity is an important modifiable risk factor associated with hypertension disease. This relationship is explored by a large number of investigators in different studies. These studies explored

that sports activity have clear impact on blood pressure and weight gain. It is estimated that 20-30% cases of hypertension are due to interlink between obesity and sports activity (Campbell *et al*., 2015). Consistent sports activity prevents the occurrence of obesity, cardiovascular coronary and diabetes mellitus as evidenced from review of many studies (Reiner *et al*., 2013). This observation is supported by the findings that continuous exercise has been proved helpful in regulating blood pressure in hypertensive patients (Pescatello *et al*., 2015). Additionally, post exercise decrease in blood pressure is observed that helped to control blood pressure in individuals with hypertension (Salam *et al*., 2018). Decreased sports activity above forty-five years of age is also associated with the risk of developing obesity and high blood pressure inspite of the fact they are consuming same diet. This might results from storage of excess food energy as fat that remains unutilized (Loureiro *et al*., 2021). Additionally, direct relationship is established between decreased sports activity, unhealthy dietary habits and hypertension (Slimko and Mensah, 2010). Increased trend of using vehicles even for walking distance has produced proportionate decrease in physical activity. Rapid growth and industrialization is also main factor contributing to decreased physical activity (Ginting and Suci, 2023). Incidence of being overweight and obese is growing with decline in walking and rise in sedentary lifestyle (Bunc, 2016). Two year follow up study in children of south Asian background revealed that physical activity is inversely related with diastolic BP (Knowles *et. al*., 2012). Dissimilar to the observed trends, moderate to severe physical activity has not been found to be associated with either systolic or diastolic blood pressure in young Danish children (Brage et al., 2004). This conclusion is further supported by a study in young Chinese children, which described a weak relationship between blood pressure and physical activity (Wang et al., 2021).

Study Limitations: It is the small sample size.
4.2 Strength of the study: Hypertension is a chronic disorder affecting large proportion. The younger population is also being affected gradually. This study describes the association of the sports activity blood pressure.

4.3 Future Recommendations: It is reasonable to assume that sports activity can reduce the burden and risk of developing hypertension in young population.

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Data Availability Statement: All the data is incorporated within the manuscript.

Conflict of Interests: The author declares no conflict of interest.

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