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# Association of Physical Exercises with Anthropometric Parameters and Blood Pressure Among Medical Students: A Prospective Study in Jammu

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## ABSTRACT

**Background:** Physical inactivity is one of the major risk factors for the rise in cardiovascular diseases and excessive body weight among people of all ages, particularly among adults, in both developed and developing nations, according to reports. This study examines the possible associations of physical fitness with anthropometric indices and cardiovascular parameters.

**Methods:** The present study was conducted on 200 medical students at Postgraduate Department of Physiology, Government Medical College, Jammu over a period of one year from November 2019 to October 2020.

**Results:** A total of 200 participants were enrolled in the current study, of whom 113 (56.5%) were women and 87 (43.5%) men. The study population's mean age was 21.48±3.46 years, with a range of 18 to 25 years. We observed that physical activity was significantly associated with BMI, WHR, SBP and DBP (p-value<0.0001*).

**Conclusion:** The present study demonstrated that the physical activity was significantly associated with BMI, WHR, systolic BP, and diastolic BP. The bottom line of the current study suggests that regular exercise lowers the risk of hypertension by aiding in weight management.

***Keywords***: Exercise, body mass index, obesity, blood pressure, hypertension

## INTRODUCTION

Physical inactivity is one of the major risk factors for the rise in cardiovascular diseases and excessive body weight among people of all ages, particularly among adults, in both developed and developing nations, according to reports.[1-3] The scientific literature advises practicing a variety of physical exercises, while meticulously adhering to recommendations inherent to suitability and specificity for each case, as being the efficient, inexpensive, and most widely available method for everyone to reduce the negative effects of a sedentary lifestyle.[1,4-6] This is supported by the fact that physical activity and a healthy diet have an impact on anthropometric indicators, particularly those that relate to body mass, as well as cardiovascular health indicators, specifically blood pressure and heart rate.[7] Weight and waist circumference for a given height and age are crucial anthropometric factors in predicting health or disease. According to Grossl, Augustemak de Lima, and Karasiak, the concentration of body fat, particularly abdominal obesity, is a contributing factor to a number of cardiovascular and metabolic illnesses as well as being linked to a high risk of death.[8] Additionally, physical exercise has a positive impact on blood

pressure and heart rate indicators, meaning that people with motor skill-related lifestyle habits, whether or not they are obese, have healthy cardiovascular systems. This suggests that physical exercise may act as a preventative measure for heart disease.[9]Despite the fact that there are numerous studies on the topic, little is known about how scheduled physical activity affects anthropometric factors, blood pressure, and heart rate in the medical college going student in Jammu region.

## METHODS

The present study was conducted at Postgraduate Department of Physiology, Government Medical College, Jammu over a period of one year from November 2019 to October 2020. The study was conducted on 200 medical students, belonging to 18-25 years age group, who were randomly enrolled in the study from Government Medical College, Jammu. After detailed discussion regarding the purpose and methodology of the study, all eligible subjects were requested to participate in the study.

### *Inclusion criteria*

1. Age ranging between 18 to 25 years.
2. Subjects in the state of good physical and mental well-being.

### *Exclusion criteria*

1. Age less than 18 years and more than 25 years.
2. History of diabetes mellitus, hypertension, cardiopulmonary disease, or any recent illness.
3. Subjects on medications for any illness.

A questionnaire with questions was used to study the profile of risk factors for cardiovascular disease.

### *Physical measurements*

Weight of the subjects was measured in kilograms by using calibrated weighing machine with minimum on and with shoes taken-off by the subjects. The individual stood still with body weight evenly distributed between both feet (WHO 1995).[10] The height was measured by using a vertical measuring rod fixed to wall. The individual was asked to stand straight on flat floor in front of the measuring rod with shoes taken off, a headboard was brought in contact with the uppermost part of head lightly compressing the hair for accuracy in measurement. The height was recorded to the nearest centimetre (cm) (WHO, 1995).[10]

*BMI:* Body mass index was calculated by dividing weight (Wt) measured in kilograms (kgs) by square of height (Ht) measured in metres (m) *i.e* BMI = Wt (in kg)/(Ht [in metres])$^2$. Classification of study subjects as per BMI into various categorized was done as per (WHO criteria, 1995).[10]

*Waist circumference (WC):* It was measured with a flexible inelastic tape placed on the midpoint between lowest costal margin and the upper margin of iliac crest at the end of full expiration with the subject in the standing position (WHO, 1995).[10]

*Hip circumference:* Subject stood erect with arms on the sides and feet together. It was measured at the widest circumference between the anterior superior iliac crests and the ischial tuberosities using a non-stretchable tape (WHO, 1995).[10]

*Waist-hip ratio (WHR):* It was calculated as the ratio of waist to that of hip of each subject.

- WHR > 0.9 in men indicated abdominal obesity
- WHR > 0.85 in women indicated abdominal obesity (WHO, 2008)[11]

*Blood pressure (BP):* BP was recorded by auscultatory method with the help of mercury sphygmomanometer. Systolic and diastolic BP were noted. Three readings were recorded and their mean was taken as final reading in mm Hg for SBP and DBP, respectively (Chobanian A. et al., 2003).[12]

## STATISTICAL ANALYSIS

Data obtained was entered into Microsoft Excel spreadsheet and exported to data editor of Statistical Package for Social Sciences (SPSS Ver. 23). Categorical

variables were described as frequencies and percentages. Continuous variables were described as mean and standard deviation. Chi square test was used to analyze the relationship between two categorical variables & T- Test was used to compare two continuous variables. A p value of < 0.5 was considered as statistically significant. Analysis was performed using SPSS.

## RESULTS

In this section, the results of the study will be described:

A total of 200 participants were enrolled in the current study, of whom 113 (56.5%) were women and 87 (43.5%) men. The study population's mean age was 21.48±3.46 years, with a range of 18 to 25 years. The majority of participants (48.0%) fell into the 20 to 21 year age range, while the minimum respondents (2.5%) fell into the 24 to 25 year age range.

**Table 1: Association between level of physical activity and body mass index (BMI) among the study subjects**

| Physical activity | BMI category (kg/m$^2$) | | | | *p*-value |
|---|---|---|---|---|---|
| | Underweight (<18.5) | Normal (18.5-24.9) | Overweight (25-29.9) | Obese (≥30) | |
| 1-3 days | 2 | 48 | 15 | 0 | |
| 4-5 days | 1 | 23 | 6 | 1 | |
| 6-7 days | 2 | 13 | 3 | 0 | |
| Inconsistent and nil | 4 | 64 | 16 | 2 | 0.001 |
| Total | 9 | 148 | 40 | 3 | |

We observe that there is a significant association between physical activity and BMI category (p-value<0.0001*). Within the subgroup with physical activity for 1–3 days/week, the number of subjects who belonged to underweight, normal weight, overweight and obese categories as per BMI were 2, 48, 15 and 0 subjects, respectively. Within the subgroup with physical activity for 4–5 days/week, the number of subjects who belonged to underweight, normal weight, overweight and obese categories as per BMI were 1, 23, 6 and 1 subjects, respectively. There were 2, 13, 3, and 0 patients, respectively, in the subgroup with 6-7 days of physical activity per week who fell into the underweight, normal weight, overweight, and obese categories according to BMI. The number of subjects who fell into the underweight, normal weight, overweight, and obese categories according to BMI was 4, 64, 16 and 2 subjects, respectively, among the subgroup with inconsistent or no physical activity.

**Table 2: Association between level of physical activity and blood pressure among the study subjects**

| Physical activity | Systolic BP | | Diastolic BP | |
|---|---|---|---|---|
| | Normal | High (PHT) | Normal | High (PHT) |
| 1-3 days | 21 | 44 | 20 | 45 |
| 4-5 days | 8 | 23 | 11 | 20 |
| 6-7 days | 2 | 16 | 8 | 10 |
| Inconsistent and nil | 39 | 47 | 43 | 43 |
| *p*-value | 0.0001 | | 0.0001 | |

BP: blood pressure; PHT: prehypertensive

Both systolic and diastolic blood pressures are found to be significantly influenced by physical exercise. Evidently, there were 21 and 44 participants with normal and high (prehypertension) systolic blood pressure, respectively, in the subgroup with physical activity for 1-3 days/week. In the same subgroup, there were 20 and 45 patients, respectively, with normal and elevated (prehypertension) diastolic blood pressure. There were 8 and 23, respectively, persons with normal and high (prehypertension) systolic BP in the subgroup that engaged in physical activity 4-5 days per week. In the same subgroup, there were 11 and 20, respectively, patients with normal and elevated (prehypertension) diastolic blood pressure. Within the subgroup with physical activity for 6–7 days/week, the number of subjects with normal and high

(prehypertension) systolic BP was 2 and 16, respectively. In the same subgroup, the number of subjects with normal and high (prehypertension) diastolic BP was 8 and 10, respectively. Within the subgroup with inconsistent or nil physical activity, the number of subjects with normal and high (prehypertension) systolic BP was 39 and 47, respectively. In the same subgroup, the number of subjects with normal and high (prehypertension) diastolic BP was 43 and 43, respectively. The level of physical activity was found to have significant association with systolic as well as diastolic BP in the study population ($p$ <0.05).

**Table 3: Association between level of physical activity and waist hip ratio among the study subjects**

| Physical activity | Waist hip ratio | | | |
|---|---|---|---|---|
| | Males (N = 87) | | Females (N = 113) | |
| | Low-risk | High-risk | Low-risk | High-risk |
| 1-3 days | 18 | 19 | 22 | 6 |
| 4-5 days | 6 | 9 | 10 | 6 |
| 6-7 days | 6 | 6 | 4 | 2 |
| Inconsistent and nil | 14 | 9 | 33 | 30 |
| *p*-value | 0.0001 | | 0.0001 | |

We noticed that both male and female study participants' levels of physical activity were significantly correlated with their waist-hip ratios (p<0.05). The number of male individuals with low-risk and high-risk waist hip ratios was 18 and 19, respectively, in the subgroup with physical activity for 1-3 days/week. There were 22 and 6, respectively, female participants in the same category who had a low-risk and high-risk waist hip ratio. The number of male patients with low-risk and high-risk waist hip ratios in the subgroup with 4-5 days of physical activity per week was 6 and 9, respectively. There were 10 and 6, respectively, female participants in the same category who had a low-risk and high-risk waist hip ratio. The number of male individuals with low-risk and high-risk waist hip ratios was 6 and 6, respectively, among the subgroup with physical activity for 6-7 days/week. There were 4 and 2, respectively, female participants in the same category who had a low-risk and high-risk waist hip ratio. There were 14 and 9, respectively, male patients with low-risk and high-risk waist hip ratios in the subgroup with inconsistent or no physical activity. There were 33 and 30, respectively, female participants in the same category who had waist hip ratios that were considered low-risk and high-risk.

## DISCUSSION

This study examined the possible associations of physical fitness with anthropometric indices and cardiovascular parameters. In our study, the physical activity showed significant association with BMI, WHR, systolic BP, and diastolic BP. Our study is in agreement with findings of Sadoh WE et al., (2016) from Nigeria who concluded that lack of physical activity contributes to increase in BMI and obesity.[13] Our study is also in agreement with study by Hegde SM and Solomon SD (2015) who revealed that regular physical activity is associated with lower blood pressure and reduced cardiovascular risk.[14] Similar finding of strong association between physical activity and blood pressure was found in the study by Pantelić S et al., (2013) from Serbia.[15] In both men and women, regular physical exercise was linked to a considerably lower risk of hypertension, regardless of age, and education. Subjects who were overweight or obese also had a higher risk of developing hypertension. Physical activity consistently had a protective impact on subjects of both normal and excess weight. Cross-sectional study analyses have shown that physical activity has a negative relationship with blood pressure and the prevalence of hypertension.[16-18] However, research on the potential link between regular physical exercise and the risk of hypertension is

sparse, and the findings are conflicting. The impact of aerobic exercise on blood pressure was examined in a meta-analysis that comprised 54 clinical studies with 2419 participants.[19] Mean systolic and diastolic blood pressure both significantly decreased after aerobic exercise, by 3.8 and 2.6 mm Hg, respectively. Aerobic exercise lowered blood pressure in both hypertensive and normotensive people as well as in overweight and normal-weight participants. The results of their meta-analysis showed that all types of exercise appeared to be successful in lowering blood pressure because the BP decrease associated with aerobic exercise did not substantially differ among trials with diverse types, frequencies, and intensities of exercise intervention.[19] Among Harvard male alumni, a prospective study found that males who did not engage in intense exercise had a 35% greater risk of hypertension than those who were more active, which is consistent with our study.[20] Another Finnish study discovered that males who engage in intense physical activity have a lower risk of developing hypertension and have improved anthropometric indices, which is compatible with our study.[21] Physical exercises during leisure time decreased the incidence of hypertension in middle-aged white males, but not in black men, according to the Atherosclerosis Risk in Community Study (ARIC).[22] A recent Japanese prospective study found that the amount of time spent walking to and from work and the frequency of physical activity during free time - at least once a week - decreased Japanese men's risk for hypertension and obesity, which is consistent with our study.[23] When comparing those with low levels of physical fitness to those with high levels, Blair et al. found a 52% increased risk of hypertension.[24] Only two prospective studies examined the relationship between physical activity and the risk of hypertension in men and women individually, and neither group was significantly associated.[21,22] However, our results demonstrated an inverse relationship between rigorous exercises and the risk of developing obesity and hypertension which is also supported by Hu et al.[18] Physical activity-induced drops in blood pressure may be explained by the heart's lower stroke volume and contractility following exercise, as well as the decreased systemic vascular resistance brought on by a drop in sympathetic activity.[25,26] Other proposed pathways include decreased plasma renin activity and catecholamine levels26, as well as enhanced insulin sensitivity and urine salt excretion.[28] Increased physical activities may lower blood pressure via lowering body weight or improving body fat distribution. In the present study, we found that people participating in any degree of physical activity had a higher chance of developing hypertension if they were overweight. Independent of baseline BMI, high physical activity was linked to a decreased incidence of hypertension. Additionally, both overweight and normal weight subjects consistently benefited from physical activity's preventive effects. Physical exercise should be seen as a key step in the prevention of hypertension among overweight and obese people, assuming our finding is indicative of a causal link between the incidence of hypertension and physical activity.

## CONCLUSION

The present study demonstrated that the physical activity was significantly associated with BMI, WHR, systolic BP, and diastolic BP. Our study's findings fundamentally suggest that increasing physical activity may reduce blood pressure through either a decrease in body weight or an improvement in the distribution of body fat. Although physical activity was found to have a protective effect in both sexes, the impact of lingering confounding factors from lifestyle factors cannot be entirely discounted. The bottom line of the current study suggests that regular exercise lowers the risk of hypertension by aiding in weight management.

***Declaration by Authors***
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