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CORRELATION OF BODY MASS INDEX WITH BLOOD PRESSURE: A GENDER BASED COMPARISON IN MEDICAL STUDENTS.

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ABSTRACT: The Obesity and Hypertension are major risk factors of several life threatening diseases in human body. **Objectives:** To determine correlation coefficient of Body Mass Index with blood pressure: a gender based comparison in medical students. **Study Design:** Comparative Cross-sectional study in students. **Setting:** Physiology department of BMU Karachi. **Period:** Duration of this study was 6 months from February 2017 to August 2017. **Material and Methods:** A total of 500 students were enrolled in this study. The anthropometric measurement [height (m^2) and weight (kg)] was recorded for calculation of the Body Mass Index (BMI) and blood pressure (BP) was measured by using sphygmomanometer with stethoscope. SPSS version 22.0 was used to analyze the data. **Results:** BMI overall in both genders were significantly ($p<0.05$) correlated in mean Systolic Blood Pressure (SBP) and mean Diastolic Blood Pressure (DBP). Underweight and Normal weight were not correlated with both mean SBP and mean DBP in both genders. Overweight subjects were positively correlated with mean DBP in males and mean SBP in females ($p<0.05$). Obese students were not significantly ($p>0.05$) correlated with both mean SBP and mean DBP in males whereas, there were not enough observations to draw any meaningful conclusion in females. **Conclusion:** Overweight subjects were positively correlated ($p<0.05$) with mean DBP in males and mean SBP in females and overall BMI (mean SBP & mean DBP) in both genders.

Key words: BMI, Blood Pressure, Correlation, Obesity, Gender.

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INTRODUCTION

Obesity and being overweight are the most common nutritional disorders in developed or industrialized countries. Excessive body fat deposition or excessive adipose tissue accumulation in the human body or increased body mass index (BMI) is exceedingly harmful to the human health. Prevalence of obesity was seen in developed as well as underdeveloped countries including African and Asian countries. Obesity has increased worldwide, nearly three times between 1975 and 2016 and more than 1.9 billion adolescents' and adults were overweight, out of these more than 650 million were obese and 39% in male and 40% in female genders were overweight. Overall about 13% of adult population is obese (11% in male and 15% in female gender). Obesity or Overweight can be defined as abnormal fat deposition or excessive fat deposition in human body that may impair health. Body mass index (BMI) or Quenelle's index is a simple index of weight-for-height that is commonly used for classification of body weight into overweight and obesity in adults. It is defined as a person's weight (kg) divided by the height in meters (m^2).[1] The morbidity and mortality and reduced life expectancy increase with increases in BMI that is more than 27.8 kg /m2 in men and 27.3 kg /m2 in females.[2] Many studies have demonstrated that obesity is directly related to high systolic blood pressure (SBP) and diastolic blood pressure (DBP) elevation, dyslipidemia or hyperlipidemia, diabetes, etc.[3,4,5] Globally, according to World Health Organization estimates, the overall prevalence of high blood pressure (BP) in adults aged 25 and over was around 40% and causes 7.5 million deaths annually.[6] The world health organization more recent estimates put

the total prevalence of increased blood pressure in Pakistan at 25.2% (25.6 in male and 24.8% in female genders).[7]

Hypertension is defined as systolic blood pressure (SBP) of 140 mmHg or more of this value and diastolic blood pressure (DBP) of 90 mmHg or more of this value or taking antihypertensive medication.[8] The prevalence of high blood pressure or hypertension among adolescents age group is approximately 3.5%.[9] Various factors affects the blood pressure including BMI, age, gender and sedentary life style. Our objective of this present study is to determine correlation of Body Mass Index (BMI) with systolic blood pressure (SBP) and diastolic blood pressure (DBP) on gender bases in medical students.

SUBJECTS AND METHODS

Setting
This study was done in students of MBBS, BDS, DPT of Baqai Medical University, who were attending the physiology department during classes, practical and tutorial timings.

Study Subjects
A total of 500 adolescents' students; 250 males and 250 females with age ranges from 18-25 years, who have no comorbid. Ethical clearance was obtained from the Ethical review Committee of Baqai Medical University Karachi. All the participants were briefed about the research procedure and its significance. All those students, who were willing & had written consent were included in this study and students were having morbid obesity and history of hypertension or taking antihypertensive medicines were excluded.

Duration
Duration of study was 6 months from February 2017 to August 2017.

Study Design
Comparative, observational, Cross-sectional study in adolescents 'medical students.
Sampling Technique: Non-Probability Convenience Sampling.

Data
Data were collected and gathered with the help of pre-tested questionnaire.

The anthropometric measurement [weight (kg) and Height (m^2)] were done by using Digital scale and height was measured by standing straight along the wall with the back towards the wall and height was marked on the wall with a marker. It is measured by measuring the distance between the floor and the mark by measuring tape. The height of students were taken in inches, which had been converted to meter square, as to calculate the body mass index (BMI) in Kg/m^2, as per the SI unit recommendations.

According to World Health Organization (WHO) criteria, students were classified into four groups (Table-I).[1]

Blood pressure (BP) was measured by standard methodology.[10] Blood pressure or arterial pressure was measured in sitting position after giving rest to students for 5–10 minutes. Arterial pressure or Blood pressure was recorded to the nearest 2 mmHg. All blood pressures or Arterial pressures were recorded at the same time of the day, i.e., during afternoon hours. Blood pressure or Arterial pressure was measured by using sphygmomanometer with stethoscope. It was recorded by the same person and by the same instrument.

Students Data were verified for missing or incomplete entries and then entered in SPSS. SPSS version 22.0 was used for analyzing the collected or gathered data. Microsoft word and Excel were used to generate tables and colored graphs in this study. The correlation between BMI and Blood Pressure on bases of gender was assessed by calculating the correlation coefficient [rho (ρ)], and the $p<0.05$ was taken as significant, while $p>0.05$ was taken as non-significant. The On bases of gender differences in autonomic regulation, data of male and female medical subjects were analyzed separately in this study.
BMI=weight in (Kg)/ (Height in meters)2

RESULTS

A total of 500 medical students of different classes of Baqai Medical University were participated in this study. They were divided into two groups according to Gender bases into male and female groups. Table-II shows the comparison of various study categorical parameters on the basis of gender and it was seen that a slightly higher percentage of males were overweight than females (31.2% vs. 26.0%) whereas a slightly higher percentage of females were obese than males (2.8% vs. 0.8%). A majority of both males and females were normotensive for both systolic blood pressure (56.8% and 70.0% respectively) and diastolic blood pressure (51.6% and 60.8% respectively). Table-III shows significant positive correlation coefficient [rho (ρ)] of BMI with mean Systolic Blood Pressure (SBP) and mean Diastolic Blood Pressure (DBP) in all 500 students $p<0.05$ on bases of gender. Underweight (BMI <18.5 Kg/m2) and Normal BMI (18.5-24.9 Kg/m2) were not having correlation coefficient [rho (ρ)] with mean Systolic Blood Pressure (SBP) and mean Diastolic Blood Pressure (DBP) in both genders. Overweight (BMI 25-29.99kg/m^2) subjects were positively correlation coefficient [rho (ρ)] with mean Diastolic Blood Pressure (DBP) only in males ($p < 0.05$) and mean Systolic Blood Pressure (SBP) only in females ($p <0.05$), In Obese (BMI>30kg/m^2) students, Body mass index (BMI) was not significantly ($p>0.05$) correlation coefficient [rho (ρ)] with mean Systolic Blood Pressure (SBP) and mean Diastolic Blood Pressure (DBP) both in males whereas there were not enough observations (available data) to draw any meaningful conclusion in females.

Classification	BMI Values (kg/m^2)
Underweight	< 18.5kg/m^2.
Normal	18.5-24.99kg/m^2.
Overweight	25-29.99kg/m^2.
Obese	>30kg/m^2.

Table-I. WHO criteria for BMI standard level

Variable	Gender	
	Male (n=250) Frequency (%)	Female (n=250) Frequency (%)
BMI		
Underweight	11.6%	12.4%
Normal Weight	56.4%	58.8%
Overweight	31.2%	26.0%
Obese	0.8%	2.8%
p-value	>0.05	
Systolic BP		
Normotensive	56.8%	70.0%
Prehypertensive	38.8%	28.0%
Hypertensive	4.4%	2.0%
p-value	<0.05	
Diastolic BP		
Normotensive	51.6%	60.8%
Prehypertensive	36.8%	30.0%
Hypertensive	11.6%	9.2%
p-value	>0.05	

Table-II. Gender wise comparison of parameters of BMI & BP. P < 0.05- significant and P >0.05- non-significance.

Variable	Males				Females			
	SBP		DBP		SBP		DBP	
	P	p-value	P	p-value	P	p-value	ρ	p-value
BMI Overall[1]	0.355	0.001*	0.225	0.001*	0.321	0.001*	0.247	0.001*
Underweight (<18.5)[2]	0.171	0.374	0.064	0.743	-0.062	0.739	0.078	0.676
Normal Weight (18.5-24.9)[3]	0.134	0.113	0.016	0.853	0.116	0.161	0.081	0.327
Overweight (25.0-29.9)[4]	0.21	0.065	0.235	0.039*	0.469	0.001*	0.188	0.134
Obese (≥30.0)[5]	0.06	0.887	0	0.999	---	---	---	---

Table-III. Correlation coefficient [rho (ρ)] of BMI with mean systolic blood pressure (SBP) AND mean diastolic blood pressure (DBP) in males and females.

Spearman correlation coefficient, ρ is rho (margin of error is 5%) [1]n=500, [2]n=60, [3]n=288, [4]n=143, [5]n=9, *P < 0.05- significant, p<0.001= highly significant and P >0.05- non-significance.

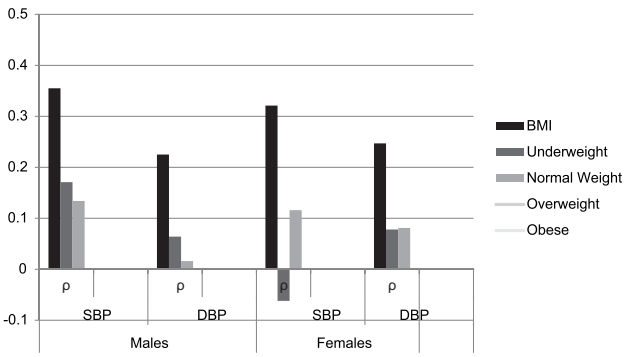

Figure-1. Correlation coefficient of Body Mass Index (BMI) with mean Systolic Blood Pressure (SBP) and mean Diastolic Blood Pressure (DBP) in males and females.

DISCUSSION

Obesity is on surge in developing countries and this is due to rapidly change in life style (i-e sedentary life style) and change in dietary habits (use of junk foods). Obesity and overweight is considered as a gate way to many life threatening diseases like metabolic syndrome, diabetes, different gastrointestinal and respiratory disease, and certain types of cancers and hypertension.[11,12,13] As Body Mass Index (BMI) or Quetelet index increases, the risk for cardiovascular complications increases like hypertension (HTN). Hypertension (HTN) has been considered as a significant risk factor for developing adulthood diseases[12] and it is associated with micro and macro vascular complications like increased incidence of Cerebrovascular Accidents (CVA) or stroke, cardiovascular diseases (CVDs) like Myocardial Infarction or heart attack and angina or Coronary heart disease (CHD), Congestive heart failure (CCF) and renal insufficiency or renal failure, liver diseases, Psychological disorders and cancers.[14] Autonomic nervous system is regulating the blood pressure (BP).[15] Obesity is associated with sympathetic activation, so it is the leading risk factor for development of hypertension.[16]

The present study was carried out on 500 adolescents' students; 250 males and 250 females with age ranges from 18-25 years, to determine correlation coefficient of Body Mass Index (BMI) with blood pressure (BP): a gender based comparison in medical students. In our study it was seen that overall Body Mass Index (BMI) had significant correlation coefficient with mean Systolic Blood Pressure in males and females and mean Diastolic Blood Pressure in males and females. The Correlation co-efficient of the categories of Underweight and Normal weight were not having significantly correlation coefficient with both mean Systolic Blood Pressure and mean Diastolic Blood Pressure in either males or females. The Correlation co-efficient of the categories of Overweight was having significantly (p<0.001) in mean Diastolic Blood Pressure in males, mean Systolic Blood Pressure in females and Obese was not having significant (p>0.001) correlation coefficient in both mean Systolic Blood Pressure and mean Diastolic Blood Pressure in males whereas there were not enough observations or data available for assessing any meaningful conclusion in females (Table-II Figure-1). This difference in observation between BMI subgroups may be due

to autonomic and metabolic activity in the body.[17] it has been observed by other researchers a higher prevalence of hypertension (HTN) in obese, and evaluated a positive relationship between body mass index and blood pressure[18], and they have shown that an obesity paradox exists between HTN and BMI.[19] The possible explanation of above observation were differences in sympathetic tone between underweight and overweight subjects.[17] It had been observed by other researchers that high prevalence of hypertension in obese and evaluated a positive relationship between body mass index and blood pressure[18] and obesity paradox exists between hypertension and body mass index.[19] The possible explanation of above observation were differences in dietary habits, socioeconomic status, sedentary life style, sympathetic tone, a protective effect of estrogen, and smoking between underweight and overweight subjects.[20] Further, it was analyzed, that overweight participants had higher blood pressure (HTN), which was statistically significant ($p<0.05$) in males but not in the females. There was also gender differences in correlation coefficient between body mass index and blood pressure.[21-23] similar results were observed by other researchers.[24,25] That supports the present study.

Thus the correlation coefficient was at best modest, and it was likely that other factors besides body mass index (BMI) influences blood pressure (BP). There were substantial evidence that supports a connection coefficient between obesity and hypertension. However the relationship between these two disorders are not a direct and forthright relationship and most likely represents an interaction of a collection of factors like Demographic, Genetic, Hormonal, Renal etc.

The kidneys had a prognostic part in the Pathogenesis of hypertension in obesity. Abnormal renal sodium handling coupled with structural changes in the kidney of an obese patient can in fact disrupts and amplify the cardiovascular hemodynamics.[26,27]

CONCLUSION

Overweight subjects were positively correlated ($p<0.05$) with mean DBP in males and mean SBP in females and overall BMI (mean SBP & mean DBP) in both genders.

Our results highlight the need of further studies targeting the younger age groups, for effective prevention and promotion of health and these should be extended to young adults in general population.

RECOMMENDATION

- Lifestyle modification, a dietary modification that is by decreasing habits of junk foods or fast foods, soft drinks or beverages and saturated fatty diet and daily use of vegetables and fruits in diet.
- Promotion of daily physical exercise so that reducing the risk of obesity and high blood pressure among university students in future.

Study Limitations

As this study was carried on university students, there were limitation of included students and fundings.

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Every new beginning comes from some other beginning's end.

"Seneca"

AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Quratulain Saleem	Data analysis, critical revision.	
3	Muhammad Rizwan	Drafting, critical revision.	
4	Erum Aamir	Drafting, Data analysis.	
5	Saleh Soomro	Concept & design of study, critical revision.	
6	Muhammad Ali	Data analysis, Drafting.	