Association of Elevated Blood Pressure and Body Mass Index with High Prevalence of Reduced Bilateral Visual Acuity in Adults.

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ABSTRACT

OBJECTIVE: To identify the effect of high blood pressure and body mass index on the visual acuity in young adults
STUDY DESIGN: A cross-sectional descriptive study
PLACE AND DURATION: Department of physiology, Mohi-ud-din Islamic Medical College Mirpur from March 10, 2017 to January 12, 2018.
METHODOLOGY: This was done on 150 undergraduate medical students. Blood pressure, height and weight were measured using standard procedure and Body Mass Index was calculated. Visual Acuity for both right and left eyes were recorded separately using E letter chart.
RESULTS: Of 150 students, >48% of the participants were overweight or obese with Body Mass Index more than 25. Obese group demonstrated significantly higher values of height, weight, Body Mass Index, systolic and diastolic pressure compared to non-obese. Mean values of visual acuity obtained from obese and non-obese subjects were significantly different ($p < 0.05$) for right eye (18.56±1.30 and 18.96±1.10) and left eye (18.08±1.79 and 18.94±1.13) respectively. Higher prevalence of low Visual Acuity was also significantly ($p < 0.05$) associated with higher systolic and diastolic blood pressure.
CONCLUSION: Reduced Visual Acuity (especially Myopia) is common among medical students and myopics are taller, heavier and have higher BMI and blood pressure.
KEYWORDS: Adult, Body mass index, Elevated blood pressure, E-Chart, Obesity, Visual acuity

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INTRODUCTION

Obesity, a serious public health problems of the 21st century, is a leading preventable cause of death worldwide[1]. Obesity is accumulation of excess body fat with negative health impact on peoples quality of life and is considered to be due to combined effects of excessive food intake, lack of physical activity, and genetic susceptibility; while endocrine disorders, medications, or mental disorder also contribute[2]. According to WHO, a person is generally considered as obese when the body mass index (BMI) is over 30 kg/m^2, while the people ranging 25–30 kg/m^2 are considered overweight[3]. The American Medical Association had classified obesity as a disease, which can be prevented by reducing foods intake high in fat or sugars, increasing fiber diet and doing exercise [4].

About 600 million adults (12%) and 100 million children were obese in 2015 worldwide[5], female more prevalent and is on continuous rise. Approximately one out of four Pakistani adults (22.2%) is obese[6].

Hypertension (HTN), the leading causes of cardiovascular disease, contributing more than seven million deaths each year worldwide. An elevated childhood blood pressure, is a strong predictor for adulthood and elder hypertension[7]. Epidemiological studies had shown an association of obesity and HTN with cardiovascular diseases, type 2 diabetes

mellitus, obstructive sleep apnea, osteoarthritis, depression, cancers (breast, prostate, colon and endometrium[8] and age related ocular diseases like glaucoma, diabetic and hypertensive retinopathy, cataract, macular degeneration, and reduced VA in the middle aged and elderly[9].

Visual acuity, how a person can focus on an object, is the ability to read a standard test pattern at a certain distance, measured in terms of a ratio to "normal" vision. Or simply, it is the measure of the eyes' ability to distinguish object details and shape at a given distance. VA resolves two points as two separate points or lines and defined by Herman Snellen as the ability to recognize an optotype when it subtended at 5 minutes of arc. Factors that determines visual acuity are: Sharpness of retinal focus within the eye, health and functioning of retina, sensitivity of the interpretative part of the brain[10,11]. Refractive errors due to abnormal eyeball shape, reduced flexibility of the lens and aberrant corneal shape are considered to be a common cause of low visual acuity. The visual acuity test, done by Snellen letter, tumbling E, and Allen picture chart, when administered in a concise and consistent manner, assess only one aspect of visual function and changes in the integrity of the visual system[12].

The incidence of obesity in all age groups generally and in the younger age group particularly is a serious issue and more vulnerable to different diseases including the visual problems. Also little literature related to the effect of obesity on the visual acuity in general and among the Pakistani young students in particular. Therefore, we designed this study to investigate whether obesity has any deteriorating effect on the visual acuity of young medical students and also to determine the extent of deterioration in terms of percentage of affected students so that they can be prevented from complications of reduced visual acuity in later life. The study was conducted to identify the effect of high blood pressure and body mass index on the visual acuity in young adults.

METHODOLOGY

This cross-sectional descriptive study was done on 150 young healthy undergraduate medical students, who gave the written consent, at Mohi-ud-Din Islamic Medical College Mirpur from March 10, 2017 to January 12, 2018, after getting approval from ethical committee of the institution. Any participant with complaints of pain, redness, itching or watering from the eye / eyes were excluded from the study.

The selection was by convenience sampling and the anthropometric measurements including age, sex, weight and height, waist and wrist were measured using standard clinical protocols. To measure weight, the students were asked to wear light clothes, and for height to stand straight on bare feet. Both height and weight were measured twice, and the mean value was recorded. BMI was calculated dividing weight by height in meter square (kg/m2). According to WHO the students were categorized for BMI purpose, 19.99 Kg/m2 as underweight, 20.0 to 24.99 Kg/m2 as normal weight; 25 to 29.99 Kg/m2 as overweight; and greater than 30 Kg/m2 as obese.

The blood pressure (BP) was measured by auscultatory method from the both arms, using mercury sphygmomanometer with an appropriate cuff size. The students were in a resting position for at least 5 min prior to measurement of pulse rate and BP. The mean of three pulse rates and BP measurements were calculated for each student and was recorded. Pulse pressure (PP) was calculated by subtracting the systolic and diastolic pressures. A mean systolic pressure greater than 140 mmHg and mean diastolic pressure greater than 90 mm Hg was taken as high.

The visual acuity was tested using Standard Logarithmic Visual Acuity tumbling E chart on stand board in well illuminated rooms, while standing the subject at a distance of 6 meters from the board. Both eyes were tested one by one with and without glasses and the non-testing eye was covered by an eye occluder. The subject started reading E lines from the top biggest letter downwards to the line till he was unable to identify the E line clearly. The last line which the student identified clearly was taken as his visual acuity and the distance written besides this line was also recorded. Visual acuity was calculated by dividing the distance of subject from stand board divided by the distance written beside the last clearly identified line. The visual acuity measurements using a tumbling E chart and standard Snellen eye chart are virtually the same.

Data Analysis: Descriptive statistics were calculated for mean age, visual acuity, BMI. A two tailed Pearson correlation was used to analyze association between visual acuity and other parameters. A *p* value of 0.05 or less was considered statistically significant. All statistical analysis were performed using SPSS Version 17.

RESULTS

Fig-1 shows demographic characteristic of total 150 included students, male (n-75) and female (n-75). A statistically significant difference ($p<0.05$) was noticed when age, systolic and diastolic blood pressure, waist and wrist measurements were compared between the male and female groups. A same trend of significant difference ($p<0.05$) was seen when height and weight were compared, however, the difference was found to be non-significant when pulse (p-0.375), BMI (p-0.415), and visual acuity of Left eye (p-0.616) and Right eye (p-0.386) were compared.

Table-I shows comparison of factors between normal and low visual acuity using Chai square test. Out of 150 participants, 105 (70%) have normal while 45 (30%) had reduced visual acuity. All the students have near sightedness. The participants of reduced VA showed statistically significant difference ($p<0.05$) regarding BMI compared to participants with normal visual acuity. A same trend of significant difference ($p<0.05$) was seen when systolic, and diastolic blood pressure were compared between the participants of normal and reduced VA.

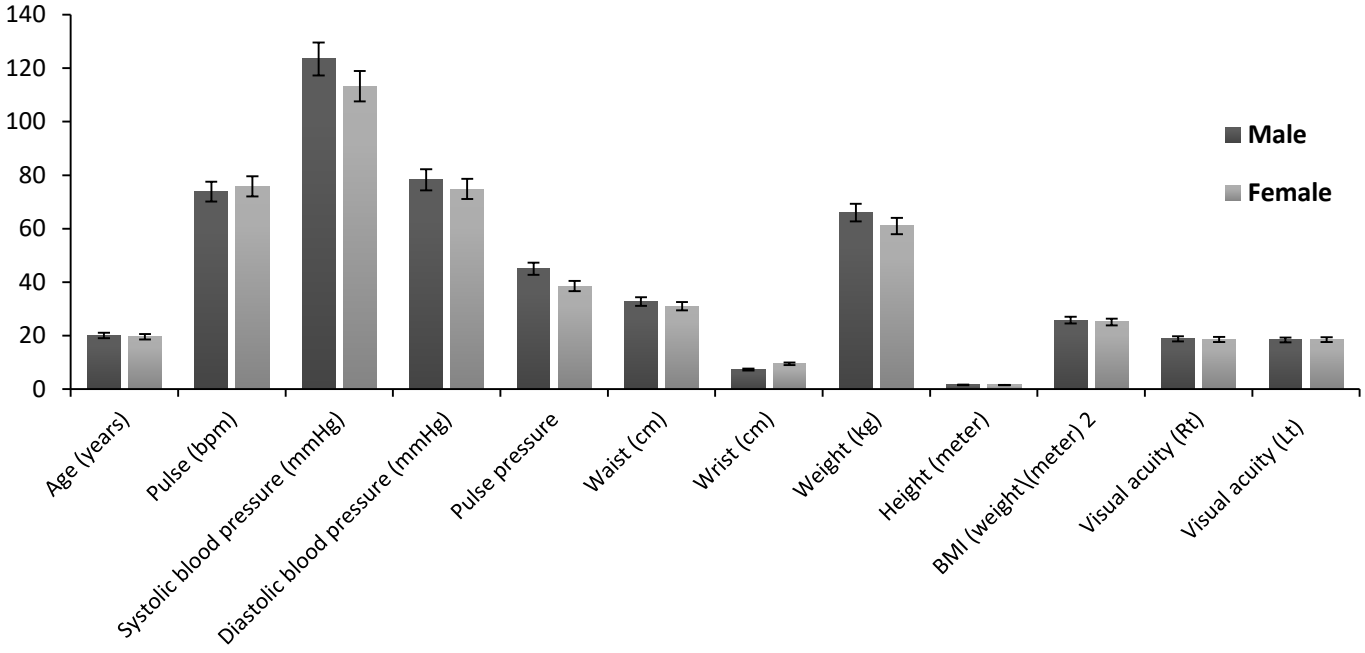

Fig-1: Anthropometric characteristic of the male and female participants (N-150)

Table I: Comparisons of associated factors between normal VA and low VA group. (N-150)

Variable	Normal VA n=105; (70%)	Reduced VA n=45; (30%)	Total N=150; (100%)	P value
BMI				
Non-obese	**65 (61.9%)**	**11 (24.4%)**	**76 (50.7%)**	**0.000**
Underweight	14 (13.3%)	02 (04.5%)	16 (10.7%)	
Normal weight	51 (48.6%)	09 (20.0%)	60 (40.0%)	0.000
Obese	**40 (24.4%)**	**34 (75.6%)**	**74 (49.3%)**	**0.000**
Over weight	24 (22.8%)	12 (26.6%)	36 (24.0%)	
Obese	16 (15.3%)	22 (48.9%)	38 (25.3%)	0.000
Blood Pressure				
Systolic blood pressure				
Up to 140 mmHg	92 (87.6%)	12 (26.7%)	104 (69.3%)	
>140 mm Hg	13 (12.4%)	33 (73.3%)	46 (30.7%)	0.000
Diastolic blood pressure				
Up to 90 mmHg	85 (81%)	15 (33.3%)	100 (66.6%)	
>90 mmHg	20 (19%)	30 (66.7%)	50 (33.4%)	0.000

DISCUSSION

Our results showed significant association of anthropometric parameters height, weight, and BMI in obese compared to non-obese participants and are in agreement with Matthew et al[13] who demonstrated higher values of height, weight and BMI in obese compared to the non-obese group; he also showed an association of obese group with increased prevalence of myopia. In our study, >48% of the participants were overweight and or obese, BMI more than 25, who showed an association with greater prevalence of low VA. Fen et al[14] showed that children with progressive myopia increase both in height and weight more quickly than those with stationary myopia. Jin et al[15] showed myopic males are 1.9 and 0.8cms taller than em-metropes. An increase in BMI may be due to increased high caloric intake, lack of exercise, parental obesity, environmental factors or overwhelming use of mobiles, laptops or tablets for academic or recreational purposes[16].

There is increased incidence of myopic prevalence among obese medical students. Our results are in agreement with Syed et al[17] who demonstrated an increased incidence of 45% myopic prevalence among obese medical students; however, in our case prevalence was 30% and all students with low VA were myopic. The obese medical students due to their heavy academic engagements, sedentary life style and decreased outdoor activities especially during the daytime are more prone to have decreased visual acuity compared to non-obese in the form of myopia[18].

Myopia, one of the commonest causes of visual impairment all over the world, is a public health problem due to its potential

ocular complications and socioeconomic burden. Myopia has association with decreased physical activity and studies showed inverse relation of myopia with increased outdoor activities. In outdoor, while a subject viewing at a distance, tension in the ciliary body and the extra-ocular muscle of convergence are relaxed[19].

A vision of 6/6 or 20/20 is taken as normal vision with which a person can face well in any field (studying, working place) without correction; furthermore, generally in young adults, a good vision is between 20/18 and 20/16[20].

An emmetropic eye focusing a distant object, reduces the hyperopic blurring when focuses a nearby object. In light, as in outdoor, there occurs constriction of the pupils associated with greater visual field and decreased image blurring due to release of dopamine from the retina that also inhibits eye growth. The near works are done by most of the medical students like reading books, using computers laptops or mobiles for academic requirements or refreshment, may be an important factor for increasing trends of low VA (myopia) in adults[21, 22].

Our results also showed significantly increasing trends of low VA among young adults with systolic and diastolic pressure. The pathological mechanism is still not clear, however, an increase in blood pressure may leads to reduced blood flow in small and medium sized blood vessels as a result of local or systemic hemodynamic changes in blood vessels supplying the eye, (ophthalmic or retinal artery and capillaries). The decreased ocular blood flow results ischemic damage of the optic nerve and/or the ganglion cells playing a prominent role in the progression of glaucoma and chance of developing low VA in both male and female adults[23-25].

CONCLUSION

Reduced Visual Acuity (especially Myopia) is common among medical students and myopics are taller, heavier and have higher BMI and blood pressure.

CONTRIBUTION OF AUTHORS

Ali I: Conceived idea, Manuscript final reading and approval
Haq IU: Designed research methodology,
Kalsoom O: Data collection, Data interpretation
Qayyum Z: Statistical analysis
Munir TA: Literature review, Manuscript writing
Khan A: Manuscript final reading and approval
Jan AA: Literature search

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