



Association and Correlation between Body Mass Index, Blood Pressure, and Visual Acuity in Students of Health Care Institution

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ABSTRACT

Background: Obesity is one of the major public health problems with its prevalence increasing at overwhelming rates. It also increases the risk of several systemic diseases such as coronary heart disease. **Aim and Objectives:** To study the correlation between body mass index (BMI) and blood pressure (BP) on visual acuity among apparently healthy young individuals and to compare these variations between boys and girls of the same age group. **Methodology:** This cross-sectional, comparative study was conducted amongst 200 subjects (100 male and 100 female subjects), age group (18-25 years) for whom blood pressure and BMI were measured with standard procedure, visual acuity was measured using Snellen's chart. **Results:** The study population consists of 100 male and 100 female (mean age 20.72 ± 2.23 years). The majority ($n=165$) of the respondents had normal visual acuity. However, compared to the respondents of normal BMI and visual acuity in males (R 19.16 ± 1.5 ; L 19.05 ± 3.50), visual acuity of underweight (R 18.53 ± 2.30 ; L 18.45 ± 2.70) and obese (R 15.68 ± 4.79 ; L 17.73 ± 1.70) were more deviated. In case of females, normal visual acuity was (R 19.5 ± 2.72 ; L 19.07 ± 1.13) while visual acuity of underweight (R 17.03 ± 2.30 ; L 17.53 ± 2.70) and obese (R 14.08 ± 4.71 ; L 17.03 ± 1.70) respectively. Blood pressure range and visual acuity in normal respondent males subject was (SBP 121.21 ± 10.20 DBP 76.6 ± 6.08 mmHg); (R 18.03 ± 2.54 ; L 18.04 ± 4.11), in hypotensive (R 15.9 ± 7.45 ; L 15.03 ± 10.18), and in hypertensive (R 15.07 ± 21.28 ; L 15.06 ± 11.87) respondents had deviated visual acuity, while in case of females (SBP 107.5 ± 10.20 DBP 72.3 ± 10.03 mmHg) (R 18.00 ± 1.54 ; L 18.03 ± 43.11), hypotensive (R 16.9 ± 6.48 ; L 16.03 ± 10.19), and hypertensive (R 14.07 ± 19.28 ; L 14.06 ± 10.87) respondents had deviated visual acuity. **Conclusion:** Abnormal body weight (underweight and obese) and BP (hypotension and hypertension) have potential negative impacts on visual acuity.

Keywords: BMI, Blood pressure, Visual acuity, Obesity

INTRODUCTION

Obesity as a health risk needs no more introduction in the present global scenario. It is a major public health problem with prevalence increasing at overwhelming rates [1-4]. Ethnicity and socio-economic status have been found to be two separate independent factors influencing BMI in men and women. Similarly, the global prevalence of hypertension is on the increase. In a recent community based study of urban and rural population in India, the prevalence amongst men 35.1% of those surveyed had a BMI of ≥ 25 . 47.6% of urban women surveyed were overweight, with 16.4% having a BMI of ≥ 30 . A recent report published by Harvard medical gazette puts the prevalence of hypertension in India at 20.0% for men and 24.4% for women [5]. Obesity also affects visual acuity negatively, but the ocular conditions which are associated with it and its potential implications are still unclear. Hypertension has also been reported as a cause of blurred and altered vision [6-8]. According to studies published in recent years, visual impairment adds to the burden of several micro-vascular and macro vascular complications in people with diabetes and compromises the quality of life [9-13]. It is the fact of concern that limited studies have been carried out to investigate the influencing body weight and blood pressure on visual functioning such as visual acuity and there is a paucity of studies showing gender variations amongst these parameters. Hence, the study was undertaken to see the correlation between body mass index (BMI) and blood pressure (BP) on visual acuity among apparently healthy young individuals and to compare these variations between boys and girls of the same age group.

PATIENTS AND METHODS

The present study was conducted in the month of May 2016-June 2016 at Department of Physiology MGMCRI. The study population consists of 200 subjects (100 male and 100 female subjects), age group (18-25 years) (2nd year MBBS, BDS, and nursing students).

Inclusion Criteria

- Subjects with no history of eye problems (visual pathology)
- Head trauma and normal eye health were included in this study

Exclusion Criteria

- Subjects who use glasses
- Age above 25 years
- History of any visual impairment, as well as those who are on medication due to illness, were excluded from this study

The study was initiated after obtaining the institute ethical clearance, before enrolment for the study; informed consent was obtained from all the participants. Data was obtained using direct interview and a pretested questionnaire, which was designed to elicit information on socio-demographics, blood pressure, weight, and height measurement, visual acuity was determined using the standard procedure. Blood pressure was measured using a manual method and sphygmomanometer, the measurement was performed 3 times at an interval of 10 minutes and the average was recorded. Weight (Kg) was measured using the simple standard weighting machine. Height (cm) was measured using tape rule (India). Body mass index was accessed by calculation using the values obtained for weight (Kg) and height (m). The current WHO BMI cut-off points classify values less than 18.5 Kg/m² as underweight; 18.5 to 24.9 Kg/m² as normal weight; 25 to 29.99 Kg/m² as overweight; and greater than 30 Kg/m² as obese [14]. The visual acuity was tested in each eye separately, in a recommendation with the previous authors using Snellen chart after following standard procedure. Data collected was analyzed for statistics using a statistical software package (SPSS version 17) the simple mean and percentages were used while the test for significance was done using the one way analysis of variance.

RESULTS

The study population consists of 100 male and 100 female (mean age 20.72 ± 2.23 years) for both boys and girls. Out of 100 male 64 (64%) had normal visual acuity, while 36% had poor visual acuity, out of 100 females 69 (69%) had normal visual acuity while 31% had poor visual acuity. However, male respondents with normal body weight had a very good visual acuity of 19.16 ± 1.5 in the right eye and 19.05 ± 3.50 in the left eye, visual acuity of underweight males for right eye was 18.53 ± 2.30 while that for left eye was 18.45 ± 2.70 , while those who were overweight and obese visual acuity for right eye was 15.68 ± 4.79 while that of left eye was 17.73 ± 1.70 . In the case of a female, respondents with normal body weight visual acuity were 19.5 ± 2.72 for the right eye and 19.07 ± 1.13 for the left eye. Visual acuity of underweight females for right eye was 17.03 ± 2.30 and for the left eye it was 17.53 ± 2.70 had normal visual acuity while visual acuity of underweight and for overweight and obese females it was 14.08 ± 4.71 for right eye; and 17.03 ± 1.70 for left eye (Table 1).

Table 1 Relationship between body weight and visual acuity (males and females)

Males			Females		
Body weight	Right eye visual acuity	Left eye visual acuity	Body weight	Right eye visual acuity	Left eye visual acuity
Underweight <18.5 Kg/m ²	18.53 ± 2.30	18.45 ± 2.70	Underweight <18.5 Kg/m ²	17.03 ± 2.30	17.53 ± 2.70
Normal weight 18.5 to 24.9 Kg/m ²	19.16 ± 1.5	19.05 ± 3.50	Normal weight 18.5 to 24.9 Kg/m ²	19.5 ± 2.72	19.07 ± 1.13
Overweight/Obese 25 to 29.99 Kg/m ² as overweight; and greater than 30 Kg/m ² as obese	15.68 ± 4.79	17.73 ± 1.70	Overweight/Obese 25 to 29.99 Kg/m ² as overweight; and greater than 30 Kg/m ² as obese	14.08 ± 4.71	17.03 ± 1.70

Values are mean ± standard deviation; mean values with different superscripts are significantly different at p<0.05

In the case of male subjects, blood pressure range recorded in normal respondents (n=64) were SBP=121.21 ± 10.20; DBP 76.6 ± 6.08, had mean visual acuity of 18.03 ± 2.54 for right eye while 18.04 ± 4.11 for left eye, in hypotensive male's (n=9) acuity of vision for right eye, was 15.9 ± 7.45; and that for left eye was 15.03 ± 10.18, and in hypertensive male's (n=27) visual acuity for right eye was 15.07 ± 21.28; and that for left eye was 15.06 ± 11.87. While in case of females (n=69) blood pressure range recorded in normal respondents were (SBP107.5 ± 10.20 DBP 72.3 ± 10.03 mmHg) had a mean visual acuity of 18.00 ± 1.54 for right eye; and 18.03 ± 43.11 for left eye, hypotensive females (n=29) had 16.9 ± 6.48 visual acuity for right eye and for left eye was 16.03 ± 10.19, and hypertensive females (n=4) visual acuity for right eye was 14.07 ± 19.28 and for left eye it was 14.06 ± 10.87. Over all, hypertensive males had more impaired visual acuity, while hypotensive females had more impairment in visual acuity (Table 2).

Table 2 Relationship between blood pressure and visual acuity (males and females)

Males			Females		
Blood pressure	Right eye visual Acuity	Left eye visual acuity	Blood pressure	Right eye visual acuity	Left eye visual acuity
Underweight (n=9) SBP=110.21 ± 4.09; DBP 70.6 ± 5.03	15.9 ± 7.45	15.03 ± 10.18	Underweight (n=29) SBP=104.03 ± 6.20; DBP 60.6 ± 8.08	16.9 ± 6.48	16.03 ± 10.19
Normal weight (n=64) SBP=121.21 ± 10.2; DBP 76.6 ± 6.08	18.03 ± 2.54	18.04 ± 4.11	Normal weight (n=69) (SBP107.5 ± 10.20 DBP 72.3 ± 10.03 mmHg)	18.00 ± 1.54	18.03 ± 43.11
Overweight/Obese (n=27) SBP=138.11 ± 10.2; DBP 86.6 ± 8.08	15.07 ± 21.28	15.06 ± 11.87	Overweight/Obese (n=4) SBP=121.21 ± 7.20; DBP 78.6 ± 8.08	14.07 ± 19.28	14.06 ± 10.87

Values are mean ± standard deviation; mean values with different superscripts are significantly different at p<0.05

DISCUSSION

World Health Organization (WHO) global initiative tagged vision 2020 "Right to Sight" is very important considering the findings of this study on the population with poor visual acuity; the World Health Assembly passed a resolution for the elimination of avoidable blindness and urged member states to support the global initiative [15]. The unique feature of this study was that the target population was young, which will help to build a road map for further studies in other age groups too; this study not only focuses on the impact of BMI and blood pressure on visual acuity but also shows how it affects the gender variably. The method which was used in this study to detect the visual acuity was no doubt remains a simple and cost effective means of detecting visual problems which would have gone undetected.

The present study shows that out of 100 male 64 (64%) had normal visual acuity, while 36% had poor visual acuity, out of 100 females 69 (69%) had normal visual acuity while 31% had poor visual acuity. For both male and female respondents with normal body weight and blood pressure, the visual acuity was almost the same in both eyes. For both group respondents in the overweight and obese individuals, visual acuity was better in the left eye. Our findings are consistent with the findings of Ernest-Nwoke, et al., who studied the relationship between body mass index (BMI) and blood pressure (BP) on visual acuity among apparently healthy residents of Ekpoma, Esan West Local Government Area of Edo State, Nigeria [2]. However, there are few researchers who have noted no difference in visual acuity of both eyes [16].

In our study, we found that overweight and obese respondents had poor visual acuity than the underweight in case of male subjects. Visual acuity was also seen affected in underweight individuals, in case of females, underweight subjects were having poor visual acuity as compared to overweight and obese, which is similar with the findings of Bergman, et al., who reported a negative association between obesity and visual acuity [17]. Unlike the present study where underweight females who have poor visual acuity, Momeni-Moghaddam, et al., in their study, reported the worst binocular performance in underweight subjects. Likewise, blood pressure too is a highly sensitive parameter, any deviation from the normal level may tend to affect the visual acuity, low and high blood pressures affect visual acuity in the same way and in the same degree [2,3,10]. Similar findings were also observed in the study done in hypertensive subjects uncontrolled type, associated with serious end-organ damage such as heart disease, stroke, renal disease, and blindness [18-20].

Our observations are consistent with the observations of Rodriguez, Dionne, and Fisher, et al., who showed that

hypertension/high blood pressure causes blurred and altered vision [6-8]. Ozor, et al., reported that the underweight, overweight, and obese subjects are wider near the point of convergence, he has also reported high blood pressure to increase near the point of convergence and this correlates with the finding of this study [21]. Our findings are in consistent with the findings of Flammer, et al., who concluded that the eye may indeed be a window to the heart. Vasculature of the eye shares many features with the vasculature of the heart and is often exposed to the same intrinsic and environmental influences and, thus, the indeed, systemic cardiovascular diseases have been associated with structural vascular changes in the retina and hence the finding of this study [22]. Abnormal body weight (underweight and obese) and blood pressure (hypotension and hypertension) have a potential negative impact on visual acuity.

This study showed that there is a relationship between weights, blood pressures, and visual acuity which is affected variably in both males and females. In fact, hypotension, hypertension, underweight, and overweight/obesity are risk factors for eye diseases as presented by our findings, as the study population was young the results can be used as a tool to screen the subjects with a risk of visual impairment to prevent further complications and problems.

CONCLUSION

Based on the findings of this study, managing and preventing abnormal blood pressures and body weights is a sure practice for ensuring normal visual functioning. Hence, eye examinations can be included as a regular screening exercise for conditions of abnormal weights and blood pressure. Therefore, calls for mass visual acuity screening of individuals in the country at large so as to join the World Health Assembly global initiative to eliminate avoidable blindness.

Limitations of the Study

The major limitation of this study was the usage of the Snellen chart for measuring visual acuity rather than in a standardized research setting or using more sophisticated study charts that would have pointed out other visual pathologies.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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