

Pre-Hypertension in Apparently Healthy Young Adults: Incidence and Influence of Haemoglobin Level

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ABSTRACT

Introduction: Prehypertension is a precursor of clinical hypertension and consequently of the cardiovascular disease. Recent studies have found positive correlation between Haemoglobin Level (Hb) and Blood Pressure (BP). But the presumed association between Hb and BP has not been investigated in healthy young adults.

Aim: This study aimed to estimate the incidence of prehypertension and the influence of Hb level on BP in healthy young adults.

Materials and Methods: This was a cross-sectional study done in 84 apparently healthy undergraduate medical students aged between 18-23 years, of either sex. In study subjects, BP

and haemoglobin content was measured. Prehypertension was defined as BP levels of 120 to 139/80 to 89 mm Hg. Statistical analysis was done by unpaired t-test and Pearson correlation Coefficient tests.

Results: Incidence of prehypertension was 50%. In 24% of the study subjects both systolic and diastolic BP was in prehypertensive state. In another 26% of study subjects only systolic BP was above normal. There was positive correlation between systolic BP and Hb level ($p = 0.0015$).

Conclusion: High incidence of prehypertension especially systolic prehypertension prevails in apparently healthy medical undergraduate students. In them, positive correlation between Hb and systolic BP persists.

Keywords: Cardiovascular risk, Haemoglobin content, Systolic blood pressure

INTRODUCTION

About 31% of all global deaths was contributed by Cardiovascular Diseases (CVDs) in 2012, thus making it the leading cause of death globally [1]. Recent studies have shown that BP at much lower level than predefined hypertension is at risk of cardiovascular mortality [2-4].

Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High BP defined Blood pressure levels of 120 to 139/80 to 89 mm Hg as prehypertension based on the evidence of a modest increase in cardiovascular risk among individuals with such levels [5].

Prehypertension is a precursor of clinical hypertension and consequently of the cardiovascular disease [5]. Several studies have documented the pre-hypertensive status [6-8]. Certain studies have reported prehypertension in medical students too [9,10]. But the data on incidence of prehypertension in medical students is limited and inconsistent. Recent studies find positive correlation between haemoglobin (Hb) level and BP [11,12]. The presumed association between Hb and BP has not been investigated in apparently healthy young adults. Medical undergraduate students, transcending adolescence, are entering into adult hood. Clinical and academic challenges may have adverse effect on their lifestyle, predisposing vulnerable subjects to hypertension. So this study aimed at estimating the incidence of prehypertension in apparently healthy medical students and finding the correlation between Hb level and blood pressure.

MATERIALS AND METHODS

This was a cross-sectional study done in undergraduate medical (MBBS) students. It was done after obtaining the institutional Ethics committee approval and informed consent from the study participants.

Study subjects

The study population comprised of students of a medical college situated in coastal Karnataka, India. A total of 84 medical students

aged between 18-23 years, of either sex and apparently healthy were studied.

Study protocol

All the study procedures were carried out between 4-6 pm in all the study subjects. Prehypertension was defined as BP levels of 120 to 139/80 to 89 mm Hg [5]. Haemoglobin level below 13.5 gm% for males and 11.5gm% for females was taken as low [13].

Study procedures

Blood pressure was measured in the right arm in the sitting position by digital BP machine for saving time and feasibility.

Haemoglobin estimation was done by digital haemoglobinometer immediately after obtaining a drop of subject's blood by finger prick with a glucometer, taking aseptic precautions.

STATISTICAL ANALYSIS

The data was analysed using unpaired t-test and Pearson Correlation Coefficient test. These statistical analyses were performed using SPSS version 15.0. Statistical significance was taken to be a p-value of less than 0.05.

RESULTS

Out of the 94 students who were approached, 87 turned up for the study. Among them 3 were chronic smokers and hence excluded from the study. Therefore data was collected from 84 students and analysed. In addition, none of them were consuming alcohol or had history of diabetes, dyslipidaemia or on any medication known to affect BP. Among them 42 were males and 42 were females. The mean age of the study participants was 19.69 ± 0.878 . Among the 84 students 42 were with family history of cardiovascular diseases. Out of total, 24 (28.57%) of them were vegetarians while 60 (71.43%) were non-vegetarians, 54 (64%) of the participants were leading a sedentary life while the others exercise regularly.

In 84 students studied prehypertension was detected in 42 students (50%). All of the prehypertensives were in systolic

prehypertensive range, and 20 students (24%) were diastolic prehypertensives. All those who had DBP in prehypertensive range, also had SBP in prehypertensive range. (None had isolated diastolic prehypertension).

Based on the Hb level the male and female study subjects were divided into two groups; namely anaemic and non-anaemic. The data on SBP and DBP of these groups are presented as mean \pm SD. The data on SBP and DBP in study participants with and without anaemia is presented in [Table/Fig-1,2] respectively. Among the male students, 12 males were with anaemia and 28 were without anaemia. Systolic blood pressure of male anaemic group did not differ significantly compared to without anaemia group (123.17 ± 10.06 vs. 124.14 ± 10.56 , $t = 0.27$, $p = 0.79$, [Table/Fig-1]). Among the female students, 21 were with anaemia and 23 were without anaemia. Systolic blood pressure of female anaemic group did not differ significantly compared to female group without anaemia (113.10 ± 9.99 vs. 113.04 ± 11.99 , $t = 0.02$, $p = 0.99$, [Table/Fig-1]).

Diastolic blood pressure of male anaemic group did not differ significantly compared to male without anaemia group (73.08 ± 9.04 vs. 73.71 ± 9.45 , $t = 0.19$, $p = 0.84$, [Table/Fig-2]). Diastolic blood pressure of female anaemic group did not differ significantly compared to female without anaemia group (70.90 ± 6.51 vs. 71.13 ± 7.22 , $t = 0.11$, $p = 0.91$, [Table/Fig-2]).

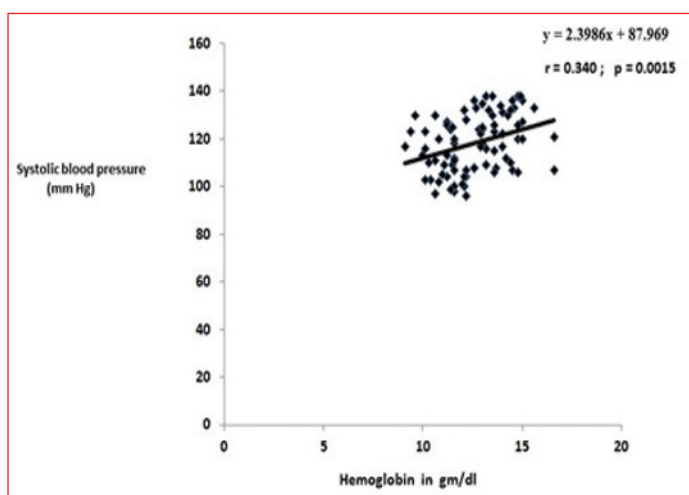
The haemoglobin level measured in 84 students ranged from 9.1 gm/dl to 16.6 gm/dl. The Correlation between BP and haemoglobin content in blood was done separately for SBP and DBP. The data on haemoglobin content of all the 84 students and their corresponding blood pressure is presented in [Table/Fig-3]. There was a significant positive correlation between haemoglobin level and SBP (Pearson Correlation Coefficient (r) = 0.340, $p = 0.0015$, [Table/Fig-3]). There was no significant correlation between Hb level and DBP (Pearson Correlation Coefficient (r) = 0.0946, $p = 0.392$).

Groups	With anaemia	Without anaemia	t-value	p-value
Males	123.17 \pm 10.06 (n=12)	124.14 \pm 10.56 (n=28)	0.27	0.79
Females	113.10 \pm 9.99 (n=21)	113.04 \pm 11.99 (n=23)	0.02	0.99

[Table/Fig-1]: Systolic blood pressure in male and female subjects with and without anaemia (values are mean \pm SD, sample size in parenthesis)

Groups	With anaemia	without anaemia	t-value	p-value
Males	73.08 \pm 9.04 (n=12)	73.71 \pm 9.45 (n=28)	0.19	0.84
Females	70.90 \pm 6.51 (n=21)	71.13 \pm 7.22 (n=23)	0.11	0.91

[Table/Fig-2]: Diastolic blood pressure in male and female subjects with and without Anaemia (values are mean \pm SD, sample size in parenthesis)



[Table/Fig-3]: The correlation between haemoglobin content and systolic blood pressure in study subjects

DISCUSSION

Haemoglobin, identified as a protein molecule in red blood cells, carries oxygen from the lungs to the body's tissues and returns carbon dioxide from the tissues back to the lungs. Thus low haemoglobin content impairs the function of red blood cell in oxygen transport leading to hypoxia in the tissues. On the other hand elevated levels of haemoglobin are associated with increased number or size of red blood cells. Recent studies have found that elevated level of haemoglobin is associated with arterial hypertension [11,12]. Thus our main aim was to find correlation between haemoglobin and blood pressure in medical students. In this study, in the same student population we also estimated the incidence of prehypertension.

In the present study incidence of prehypertension was 50% of study participants. The prevalence of prehypertension as reported by previous studies range from as low as 13.9% [14] to as high as 67% [10] in young adults. Our study finding is slightly lower compared to the findings of Shoba S et al., who had observed prehypertension in 55.4% of medical student population in a neighboring medical college of coastal Karnataka [9]. Nevertheless, study reports available on incidence of prehypertension in young adults from other parts of South India range from 37.45% [15] to 67% [10]. Chaudary K et al., have reported prehypertension in 58% of female medical students pursuing their study in Wardha situated in North India [16]. Debbarma et al., have reported prehypertension in 45% of young adults pursuing medical course in eastern part of India [17]. Reports on prehypertension from other parts of the world range from 13.9% to 46.9% [14, 18-20]. However, these recent studies on incidence of prehypertension in medical students in India and other parts of the world suggest that medical students stand a high risk of elevation of BP than what was initially assumed.

In the present study we observed a positive correlation between SBP and Hb level [Table/Fig-3]. Our finding is in accordance with the study finding of Femke Atsma et al., who had also reported positive correlation between Hb level and SBP in a large cohort of healthy individuals [12]. The underlying biological mechanisms for the reported associations are speculative. Some studies have reported that Hb is strongly related to arterial stiffness [11]. Also, it has been suggested that free Hb may be a scavenger of NO, a vasodilator, thus causing the vessels to constrict and blood pressure to increase [21]. Nonetheless, positive correlation observed between blood pressure and Hb [Table/Fig-3] but no significant influence of anaemia on blood pressure [Table/Fig-1,2] compel us to hypothesize that Hb may be a confounding factor in determining the blood pressure of a given individual.

LIMITATIONS

Present study is with certain limitations. As our primary aim was to find correlation between Hb and BP, incidence of prehypertension was estimated in a relatively small sample size owing to practical difficulties in getting students consent to participate in this study. In the present study we estimated only Hb level in relation to blood pressure. We could not measure other relevant blood parameters such as red blood count, packed cell volume, serum iron owing to financial constraint.

CONCLUSION

Based on our study findings it could be concluded that high incidence of prehypertension especially systolic blood pressure in prehypertensive range prevails in young adults pursuing medical studies. In them haemoglobin level is positively correlating with systolic blood pressure.

ACKNOWLEDGMENTS

We deeply acknowledge Indian Council of Medical Research (ICMR), New Delhi, for funding this project in the form of Short Term Students Research Programme (STS) & are grateful to all the participants who also made this possible.

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Date of Submission: **May 22, 2015**
Date of Peer Review: **Aug 02, 2015**
Date of Acceptance: **Sep 14, 2015**
Date of Publishing: **Nov 01, 2015**

FINANCIAL OR OTHER COMPETING INTERESTS: None.