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RESEARCH ARTICLE

Comparison of waist-hip ratio, prehypertension, and hypertension in young male bus drivers and non-drivers of Bengaluru city

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ABSTRACT

Background: Hypertension is a public health burden globally and is one of the major risk factors for cardiovascular morbidity and mortality. Elevated blood pressure (BP) in young adulthood leads to atherosclerosis in middle age. Bengaluru is a rapidly growing city with huge traffic congestion which leads to increased stress levels in professional bus drivers. The purpose of the study was to assess whether bus drivers had higher waist-hip ratio elevated BP as compared to non-drivers. **Aims and Objectives:** The aim of the study was to record the anthropometric parameters, measure waist-hip ratio, record systolic (SBP), and diastolic BP (DBP) in (1) Group A - 30 Bangalore Metropolitan Transport Corporation bus drivers and (2) Group B - 30 non-drivers (clerical staff) and to assess and compare the results between both the groups. **Materials and Methods:** Study included 60 subjects aged between 25 and 35 years chosen based on inclusion and exclusion criteria. Questionnaire including personal history and diet history was answered by all the subjects. Physical examination was done. Waist circumference and hip girth were measured and waist-to-hip ratio (WHR) calculated in both the groups. BP was recorded in sitting position both by palpatory and auscultatory methods in both groups. The results were tabulated and statistically analyzed. **Results:** WHR was significantly higher in the study group as compared to subjects in the control group ($P = 0.01$*). There was significant elevation of SBP ($P = 0.001$**) and DBP ($P = 0.001$**) in the study group. With respect to the years of job experience, study group had more SBP ($P = 0.001$**) and DBP ($P = 0.043$*) compared to controls. **Conclusion:** Higher waist-hip ratio and increased BP in drivers as compared to controls suggest that drivers are at high risk of developing coronary heart disease or stroke at an early age. Drivers have to be educated about lifestyle modifications to reduce stress and maintain BP within a normal range.

KEY WORDS: Bus Drivers; Cardiovascular Disease; Hypertension; Prehypertension; Waist-Hip Ratio

INTRODUCTION

Non-communicable diseases (NCDs) account to deaths of around 41 million people each year, equivalent to 71% of all deaths worldwide. Every year, 15 million deaths occur from a NCD between the ages of 30 and 69 years; over 85% of these "premature" deaths occur in low- and middle-income countries. Deaths due to cardiovascular diseases account for most NCD deaths of around 17.9 million people or 44% of all NCD deaths annually. The burden of these diseases is rising disproportionately among lower- and middle-income countries and populations.[1]

Hypertension is a NCDs which results in increased incidence of cardiovascular disease leading to increased morbidity and mortality among population. Hypertension is a major risk factor for cardiovascular disease and is directly responsible for 57% of all the stroke deaths and 24% of all the coronary heart disease deaths in India.[2] Prehypertension in young adulthood is an important risk factor for developing

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hypertension in the future. Previous studies have found that prehypertension during young adulthood is associated with overweight and dyslipidemia and results in atherosclerosis in middle age.[3,4] Therefore, young aged prehypertensive patients might suffer from coronary atherosclerosis leading to myocardial infarction and/or cerebral atherosclerosis resulting in a stroke. Moreover, coronary heart disease occurs at a much younger age in Indians as compared to those in North America and Western Europe, as Indians have smaller coronary blood vessels compared to them.[5]

Normal adult blood pressure (BP) is defined as a systolic BP (SBP) of 120 mmHg and a diastolic BP (DBP) of 80 mmHg. However, the cardiovascular benefits of normal BP extend to lower systolic (105 mmHg) and lower DBP levels (60 mmHg). HTN is defined as a SBP equal to or above 140 mmHg and/or DBP equal to or above 90 mmHg.[6] As per the Joint National Committee 7 report, the term "prehypertension" includes BP ranging from 120 to 139 mm of Hg systolic and/or 80–89 mm of Hg diastolic; hypertension Stage I includes 140–159/90–99 mm of Hg and hypertension Stage II is 160 or above systolic/100 or above mm of Hg of DBP. This classification would identify those individuals in whom early intervention by the adoption of healthy lifestyles could reduce BP, decrease the rate of the progression of BP to hypertensive levels with age, or prevent hypertension entirely.[7]

In metropolitan cities like Bengaluru, the nature of work of bus drivers is stressful and hazardous to health. Several studies have shown that there is a direct linkage between traffic congestion and psychophysiological stress.[8] Driving city buses is a tough job as drivers have to maintain the time schedule in spite of slow-moving heavy traffic in Bengaluru. Drivers due to their stressful job and physical inactivity have a higher risk of developing prehypertension and hypertension at an early age which may result in coronary atherosclerosis or stroke in middle age. In addition to this, previous studies done in other parts of the world have found that exposure to air pollution and noise pollution also leads to elevated BP in bus drivers.[9,10] Moreover, hence, bus drivers could be more prone to cardiovascular disease at an early age which would result in premature deaths. Hence, early evaluation of prehypertension and hypertension along with measurement of waist-hip ratio in bus drivers offers a possibility for lifestyle modification and to prevent further complications. Previous studies done have included the bus drivers of middle age, and there is a paucity of studies conducted in young aged bus drivers of Bengaluru City to evaluate prehypertension, hypertension, and waist-hip ratio. Therefore, this comparative study was undertaken to assess an early onset of prehypertension and hypertension with an increase in waist-hip ratio in drivers of Bangalore Metropolitan Transport Corporation (BMTC). The results were compared with the parameters of age- and sex-matched nondrivers (clerical staff) who work indoors most of the time. The results of the study would enable us to create awareness among drivers about lifestyle modifications and prevent cardiovascular diseases in future.

MATERIALS AND METHODS

Ethical clearance for the study was taken from the Institutional Research and Ethical committee of Bangalore Medical College and Research Institute, Bengaluru. A comparative study was conducted in BMTC bus depot, Bengaluru including 60 subjects of age group 25–35 years. Subjects were selected based on inclusion and exclusion criteria. The study included the male healthy volunteers willing to give written informed consent and participate in the study. Subjects having hypertension, diabetes mellitus, thyrotoxicosis or any other endocrine disorder, tobacco chewers, smokers, alcoholics, non-vegetarians, unmarried persons, family h/o HTN, coronary heart disease, and stroke were excluded. Study group included 30 BMTC bus drivers and control group included age- and sex-matched 30 nondrivers (clerical staff).

Subjects were explained about the protocol of the study, and informed consent was taken. Subjects were asked to avoid caffeine for at least 1 h before the study. Study was conducted between 8 30 am and 9 30 am in the morning. Subjects answered a questionnaire in relation to their personal history and diet history and physical examination was done. Waist circumference measured at the midpoint between the iliac crest and the lower margin of the last palpable rib in the mid-axillary line.[11] Hip girth measured around the largest circumference of the buttocks, over the minimal clothing, subject standing erect with weight evenly distributed on both feet and legs slightly apart.[11] Moreover, waist-to-hip ratio (WHR) was calculated. BP was measured in sitting position using a standard mercury sphygmomanometer on two different occasions, with at least 15 min gap, both the readings and the average were noted. BP was classified as per the Joint National Committee on prevention, detection, evaluation, and treatment of BP (BP in pre-HTN - 120–139/80–89 mmHg, HTN Stage I - 140–159/90–99 mmHg, and HTN Stage II - 160 or above/100 or above mmHg). Subjects with normal BP (systolic and diastolic <120/80 mm of Hg) were grouped as "normotensive" and those who had BP between systolic 120 and 139 or diastolic 80–89 mm of Hg were classified prehypertensive and those in the hypertensive Stage I or II were classified as "hypertensive."

The results were tabulated in a master chart and statistically analyzed using the software, namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 and Systat 12.0, and R environment ver.2.11.1. Microsoft Word and Excel have been used for generating graphs, tables, etc.[12-14] Descriptive statistical analysis has been carried out in our current study. Results on continuous measurements are represented on mean ± SD (min-max) and results on categorical measurements are

represented in number (%). Significance was assessed at 5% level of significance. Student *t*-test (two-tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups intergroup analysis on metric parameters. Leven's test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/Fisher exact test has been used to find the significance of study parameters on a categorical scale between two or more groups.

RESULTS

The present study was a comparative study which included 60 subjects Group A - 30 BMTC bus drivers 2 and Group B - 30 nondrivers (clerical staff). Subjects in both the groups were well matched with respect to age (P = 0.971) and years of job experience (P = 0.943). WHR was significantly higher 0.89 ± 0.06 in study group as compared to subjects in control group 0.85 ± 0.04 (P = 0.01*). Body mass index (BMI) was not statistically significant between the two groups, but the study group had more BMI compared to controls. There was significant elevation in SBP (P = 0.001**) and DBP (P = 0.001**) in the study group than the control group. With respect to the years of job experience, the study group had significantly higher SBP (P = 0.001**) and DBP (P = 0.043*) as compared to controls. Drivers who had more than 5 years of job experience had higher SBP (P = 0.001**) and DBP (P = 0.030*) as compared to drivers with <5 years of job experience [Tables 1-3].

Table 1: Comparison of age, BMI, WHR, and Job experience in two groups

Variables	Drivers	Non drivers	*P* value
Age (years)	31.36±4.09	31.33±2.96	0.971
BMI (kg/m^2)	23.06±2.34	22.03±2.64	0.740
WHR	0.89±0.06	0.85±0.04	0.01*
Job experience (years)	5.15±2.84	5.20±2.56	0.943

BMI: Body mass index, WHR: Waist-hip ratio

Table 2: Comparison of BP in two groups studied

BP	Drivers *n*=30 (%)	Non drivers *n*=30 (%)	*P* value
SBP (mmHg)			
<120	8 (26.7)	20 (66.7)	0.001**
120–130	11 (36.7)	6 (20)	
130–140	8 (26.7)	3 (16.7)	
140–160	3 (10)	1 (3.3)	
160–180	-	-	
>180	-	-	
DBP (mmHg)			
<80	9 (30)	24 (80)	0.001**
80–90	18 (60)	6 (20)	
90–100	3 (10)	0 (0)	
100–110	-	-	
>110	-	-	

DBP: Diastolic blood pressure, SBP: Systolic blood pressure, BP: Blood pressure. *P<0.01, **P< 0.001

Table 3: Comparison of SBP and DBP according to job experience

BP	Drivers	Non drivers	*P* value
SBP (mmHg)			
<5 years of job experience	119.44±10.79	118.18±8.16	0.598
>5 years of job experience	134.50±12.06	123.23±9.29	0.001**
P value	0.001**	0.18	-
DBP (mmHg)			
<5 years of job experience	77.22±5.01	74.23±5.91	0.115
>5 years of job experience	82.17±6.84	77.07±4.94	0.043*
P value	0.030*	0.173	-

DBP: Diastolic blood pressure, SBP: Systolic blood pressure, BP: Blood pressure. *P<0.01, **P< 0.001

DISCUSSION

In the present comparative study consisting of 60 subjects with study group including 30 BMTC bus drivers and control group including 30 nondrivers (clerical staff), subjects in both the groups were well matched with respect to age (P = 0.971) and years of job experience (P = 0.943). Study group subjects had increased WHR 0.89 ± 0.06 as compared to subjects in control group 0.85 ± 0.04 (P = 0.01*). BMI was not statistically significant between the two groups, but the study group had more BMI compared to controls. There was significant elevation in SBP (P = 0.001**) and DBP (P = 0.001**) in the study group compared to the control group. With respect to the years of job experience, study group had elevated SBP (P = 0.001**) and DBP (P = 0.043*) as compared to controls. Among drivers, the SBP (P = 0.001**) and DBP (P = 0.030*) were significantly high in those who had more than 5 years of experience. In the study group, 10% of the subjects were found to have undiagnosed hypertension.

Our study is in agreement with study done by Udayar *et al.* who found increased WHR among transport drivers.[15] In our study, we have considered WHR is a better predictor of cardiovascular disease risk than the BMI. The previous study done by Welborn *et al.* have shown that obesity, as measured by WHR, is a dominant, independent predictive variable for CHD in both men and women. WHR is a better predictor of a cardiovascular risk factor than waist circumference or BMI, as it is less dependent on body size and height. Ideal WHR is <0.85 in men.[16] Obesity and weight gain are strong independent risk factors for HTN.[17]

Our study is in agreement with Midha *et al.* have found that physically inactive persons have a high risk of developing

hypertension than those who are physically active.[18] Increase in WHR in drivers could be attributed mainly to the increased stress levels, sedentary lifestyle, and physical inactivity. Central obesity is quite strongly associated with cardiovascular disease risk than general obesity. The adipose tissue deposition is usually associated with systemic inflammation, which has a direct effect on CVD risk.[19] WHR shows a graded as well as the highly significant relationship with the future risk of cardiovascular disease.

Our study is in agreement with Udayar *et al.* and Erhiano *et al.* who had done a cross-sectional study among drivers and found a high prevalence of HTN in drivers.[15,20] Moreover, drivers being sedentary with less physical activity and increased stress are more prone to HTN. HTN is a silent killer disease and an independent predisposing factor for heart failure, coronary heart disease, stroke, renal disease, and peripheral arterial disease. Heart disease is the most common cause of death in hypertensive patients due to structural and functional adaptations as a result of atherosclerosis. In adults, there is a continuous incremental risk of cardiovascular disease and stroke across levels of both SBP and DBP. Cardiovascular disease risk doubles for every 20 mmHg increase in SBP and 10 mmHg increase in DBP. Elevated BP is the strongest risk factor for stroke, which is the second most frequent cause of death in the world.[17] Moreover, atherosclerosis begins in childhood as deposits of cholesterol and its esters, referred to as fatty streaks, in the intima of large muscular arteries. Moreover, long-range prevention of atherosclerosis and its sequelae by control of the risk factors for adult coronary artery disease should begin in adolescence and young adulthood.[21]

Our study is in agreement with Nawaz *et al.* and Bald-Mulli *et al.* who have found that incidence of HTN is more among the drivers as they are exposed to noise pollution and air pollution.[9,10] Exposure to sound levels more than 80 dB increases the chances of development of prehypertension and hypertension.[9] Constant exposure to noisy environment several hours a day and also, exposure to vehicle derived pollutants could be the cause for elevated BP in drivers. Exposure to ambient air pollution causes increased oxidative stress and results in increased cardiovascular risk in drivers.[22] Ambient air pollution causes increased BP due to change in cardiovascular autonomic control.[10] In our study, to the best of our knowledge, we have excluded the possible causation factors for developing hypertension at a young age. Moreover, hence, increased BP in drivers as compared to non-drivers could be attributed to sedentary lifestyle, physical inactivity, exposure to air pollution, and noise pollution. Further research is required to show how exactly air pollutants can cause elevated BP and affect cardiovascular health. By this study, we could change the false assumptions in drivers that HTN does not affect young aged people.

The limitation of our study, our study was of short duration and small sample size. Furthermore, hypertension could not be classified whether it is primary or secondary as many of them had not undergone any health check-up due to their false assumption that HTN affects population only after the age of forty. Information obtained about salt intake was subjective and could not be assessed whether excessive intake of salt, low intake of calcium, and potassium were one of the causation factors of hypertension in drivers. A low dietary intake of calcium and potassium might be the added factor for hypertension in drivers.[17] Our study offers scope for similar studies including large-scale population of young aged bus drivers. Moreover, similar studies can be conducted in female bus drivers also to evaluate cardiovascular risk factors at an early age and prevent cardiovascular diseases that might occur in future.

CONCLUSION

Bus drivers had increased WHR, prehypertension, and HTN at a younger age as compared to controls. Early screening and periodical health check-up helps in early evaluation of the disease so that lifestyle modifications and treatment could be advised. Free periodical health camps would benefit bus drivers as they belong to lower income group and they would not seek any medical help unless they are symptomatic. Awareness has to be created in drivers about pre-HTN and hazards of HTN. Drivers must be advised about lifestyle modifications so as to reduce stress and increase physical activity to maintain BP within a normal range.

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