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Original Research Article

A comparative study of cardiovascular disease risk among bus drivers and bus conductors of a state transport corporation in North Goa

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ABSTRACT

Background: Bus drivers and bus conductors are predisposed to increased cardiovascular disease (CVD) risks. Driving for long duration involves prolonged sitting, which enforces sedentary behavior among drivers in comparison to conductors who have the freedom to move about in the bus. The aim and objectives of the study were to identify selected risk factors for CVDs among bus drivers and bus conductors; to estimate the CVDs risk among them using Framingham risk score and to study the difference of risk factors and CVDs risk between bus drivers and conductors.
Methods: The present study was a comparative cross-sectional study among 105 bus drivers and 105 bus conductors at the Panaji bus depot of Goa. A pre-designed semi-structured questionnaire was used to collect data along with anthropometric, clinical examination and blood investigations. The Framingham risk score with BMI and lipids was used to compare the CVD risk.
Results: Higher percentage of bus drivers had diabetes, hypertension, obesity and dyslipidemia. When the CVD risk was compared using the Framingham risk score, 63.8% bus drivers had intermediate-high CVD risk using FRS-BMI compared to 46.7% bus conductors and the difference is found to be significant. Using FRS- lipids, 65.7% bus drivers had intermediate-high risk compared to 53.3% bus conductors.
Conclusions: The behavioral risk factors for CVD were higher among bus drivers compared to bus conductors.

Keywords: Bus drivers, Conductors, Framingham CVD risk

INTRODUCTION

Cardiovascular diseases (CVD) are major non-communicable diseases in India and Goa and are mainly attributed to stress, changes in lifestyle such as diet, sedentary life etc.[1-7] Work-related stress and unfavourable working environment may play a causative role.[8,9] Studies have concluded that employees of transport industry have a higher risk of co-morbidities and mortalities in comparison to the general population.[10] Undoubtedly, the enactment of healthy lifestyles among transport employees is difficult due to their working environment and job demands i.e. irregular working hours and shifts, inadequate periods of rest, lack of sleep and irregular meal timings. They are compulsory sedentary workers as their work involves minimum physical activity and are at risks of developing unhealthy behaviours such as consumption of unhealthy foods, tobacco and alcohol. All these predispose them to morbidities and increased CVD risks compared to the population in general.[11,12]

Driving a bus is a high-risk occupation as it involves prolonged sitting, which enforces sedentary behaviour among drivers in comparison to conductors who have the freedom to move about in the bus. Also, a driver's task is

mentally demanding as he has to face conflicting tasks like maintaining schedule, driving safely etc.[13] The bus drivers and bus conductors, often due to their busy schedules are unable to go for period health check-ups and are often remain unaware of their health status. Timely prevention of development of CVDs is critical as they may lead to the following: (a) acute cardiovascular event: at during driving can put his life and that of numerous passengers and other road users at stake and (b) chronic cardiovascular disease: chronic CVD may lead to increased episodes of illness, loss of productivity at workplace.[2]

Aim and objectives

The aim and objectives of the study were to identify selected risk factors for CVDs among bus drivers and bus conductors; to estimate the CVDs risk among them using Framingham risk (FRS) score and to study the difference of risk factors and CVDs risk between bus drivers and bus conductors.

METHODS

The present study was a comparative cross-sectional study among consenting bus drivers and bus conductors at the Panaji bus depot of 30 years of age and above employed for a minimum duration of one year with no pre-existing CVD.

Study place

Data collection was done at Panaji bus depot in a separate room allotted for interview, blood collection, clinical examination, ECG. The blood collected for investigation at the bus depot and then sent to Goa Medical College and Hospital Bambolim for reporting.

Study period

The study period was of 18 months from January 2017 to May 2018.

Calculation of sample size

The sample size was calculated using G*power application version 3.1.9.2 considering:

Mean total cholesterol of bus drivers= 191±20 mg/dl and controls= 183±20 mg/dl.[14]

Confidence interval= 95%

Power= 80%

Allocation ratio= 1:1

Effective size (d)= 0.4

Two tailed t test was used to calculate difference between the two means, and the effect size (d) of 0.4 obtained was used to calculate sample size required in each group.

Total sample size= 200 (100 bus drivers and 100 bus conductors)

Sampling method

The participants were selected out of 205 bus drivers and 152 bus conductors using systematic random sampling method.

Data collection

Since study was conducted in 2 visits, to compensate for the loss to follow-up, 10% attrition was considered and sample size was increased from 200 to 210. The lists of bus drivers and bus conductors provided did not have the ages and medical history of CVDs; also exclusion criteria was also on basis of ECG at the first visit. To cover up for this exclusion, the selection process from each of the lists was repeated till the desired sample size of 105 bus drivers and 105 bus conductors was obtained. Figure 1 shows enrolment of study participants.

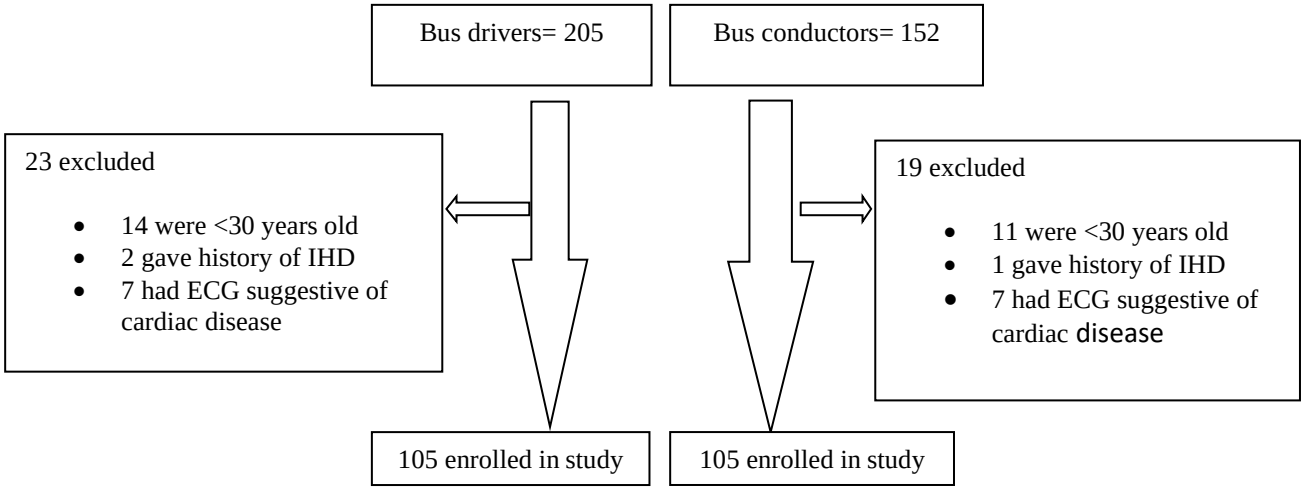

Figure 1: Enrolment of study participants.

Permissions

Permission was obtained from the STU General Manager and the depot manager of Panaji bus depot and GMC to carry out blood investigations

First visit

A face to face interview after an informed consent was conducted to obtain data using a predesigned questionnaire. Stress evaluation was done using Perceived stress scale (PSS) developed by Cohen et al.[15,16] The stress score obtained was classified as no stress (score 0-10), mild stress (score 11-20), moderate stress (score 21-30), severe stress (score 31-40). (a) clinical examination including measurement of blood pressure (bp) and heart rate was conducted; (b) anthropometric measurements, ECG and blood investigations for FBSL, HbA1C and lipids were taken.

Second visit

One week later, and heart rate recording was measured and any employee having an abnormal report was referred to GMC for necessary treatment.

Estimation of CVDs risk using Framingham risk score (FRS)[17-20]

FRS was used to calculate the 10 years CVDs risk using lipids, i.e. total cholesterol and Serum HDL and BMI and classified as shown in Table 1.[17-20]

Table 1: CVD risk classification using FRS.

Risk level	FRS (%)
Low	<10
Intermediate	10-19
High	≥20

Data handling and statistical analysis

The data was in excel and was analysed using SPSS version 22. Mean, standard deviations, t test, Chi square tests and Odds ratios were used wherever applicable.

RESULTS

Socio-demographic and work-related characteristics

The mean age of bus drivers was 47.70±7.52 years and that of bus conductors was 49.49±8.74 years. The mean number of trips per day of bus drivers was 7.37±2.41 and that of bus conductors was 7.35±2.18. The distance travelled per day on duty by bus drivers was 247.71±47.38 kms and that of bus conductors was 244.95±48.99 kms.

The mean duration of service of bus drivers was 17.90±8.85 years whereas that of bus conductors was 19.66±9.80 years.

The means working hours of bus drivers 10.96±1.98 and that of bus conductors was 10.38±1.76 (Table 2 and 3).

Table 2: Socio-demographic characteristics of study population.

Socio-demographic variables		Bus drivers		Bus conductors		Total	
		N	%	N	%	N	%
Age group (years)	30-39	18	17.1	20	19	38	18.1
	40-49	38	36.2	19	18.1	57	27.2
	50-59	49	46.7	63	60	112	53.3
	≥ 60	00	00	03	2.9	03	1.4
Religion	Hindu	94	89.5	96	91.4	190	90.4
	Christian	09	8.6	09	8.6	18	8.6
	Muslim	02	1.9	00	00	02	0.9
Marital status	Unmarried	16	15.2	15	14.3	31	14.8
	Married	89	84.4	90	85.7	179	85.2
Education status	Less than 10th std	26	24.8	35	33.3	61	29.0
	10th std and above	79	75.2	70	66.7	149	71.0
SE class	Class I	22	21.0	21	20.0	43	20.5
	Class II	76	72.3	79	75.2	155	73.8
	Class III	06	5.7	04	3.8	10	4.8
	Class IV	00	00	00	00	00	00
	Class V	01	1.0	01	1.0	02	0.9
Total		105	100	105	100	210	100

Table 3: Work related characteristics

Variables	Bus drivers		Bus conductors		Total	
	N	%	N	%	%	N
Duration of service (years)						
<10	24	22.9	26	24.8	50	23.8
10-20	42	40.0	24	22.9	66	31.4
>20	39	37.1	55	52.3	94	44.8
Total	105	100	105	100	210	100
Work-shift pattern						
9 am-6 pm	22	21.0	18	17.1	147	70.0
2 pm-2 pm (24 hours)	83	79.0	87	82.9	63	30.0
Total	105	100	105	100	210	100
Status of employment						
Permanent	104	99.0	99	94.3	203	96.7
Contract	01	1.0	06	5.7	07	3.3
Total	105	100	105	100	210	100
Mode of transport to workplace						
Public transport	81	77.1	66	62.9	147	70.0
Own vehicle	24	22.9	39	37.1	63	30.0
Total	105	100	105	100	210	100

Behavioural risk factors

21.9% bus drivers were currently consuming tobacco compared to 19% bus conductors. 54.3% bus drivers were current drinkers and 29.8% of these indulged in heavy episodic drinking. 41.9% bus conductors were current drinkers and 22.7% of these indulged in heavy episodic drinking. Only 22.9% bus drivers had adequate levels of physical activity compared to 28.6% bus conductors. 13.3% bus drivers consumed adequate amounts fruits and vegetables in comparison to 16.2% bus conductors. 41% bus drivers consumed excess of salt compared to 32.4% bus conductors. 80% bus drivers consumed High fats salt sugar (HFSS) food whereas only 68.6% bus conductors reported consuming them almost daily. Among bus drivers 29 (27.6%) had moderate stress and only 7 (6.7%) bus conductors had moderate stress. Also, when mean stress score was compared between bus conductors (15.210±4.934) and bus drivers (18.630±4.882) using student's t test the difference was statistically significant ($p<0.001$).

Hypertension, diabetes, obesity and dyslipidemia

43.8% bus drivers were hypertensives compared to 26.7% bus conductors ($\chi^2=9.24$, df=2, p value=0.009). 58.8% of bus drivers had high BP (≥140/90 mmHg) in spite of treatment. The mean heart rate and BP of bus drivers was also significantly higher than bus conductors ($p<0.05$). 32.4% bus drivers were diabetic compared to 21.9% bus conductors and the difference was significant ($\chi^2=6.0$, df=2, p value=0.04).40.8% bus drivers had high HbA1c in spite of being on treatment compared to 17.7% bus conductors who had high HbA1c while on treatment. Higher proportion of bus drivers had raised BMI, waist circumference and WHR compared to bus conductors.

Higher proportion of bus drivers had raised total cholesterol, LDL, triglycerides and lower HDL values (Figure 2). Calculation of Odds ratios revealed that bus drivers had higher odds of having risk factors of CVD in comparison to bus conductors (Table 4).

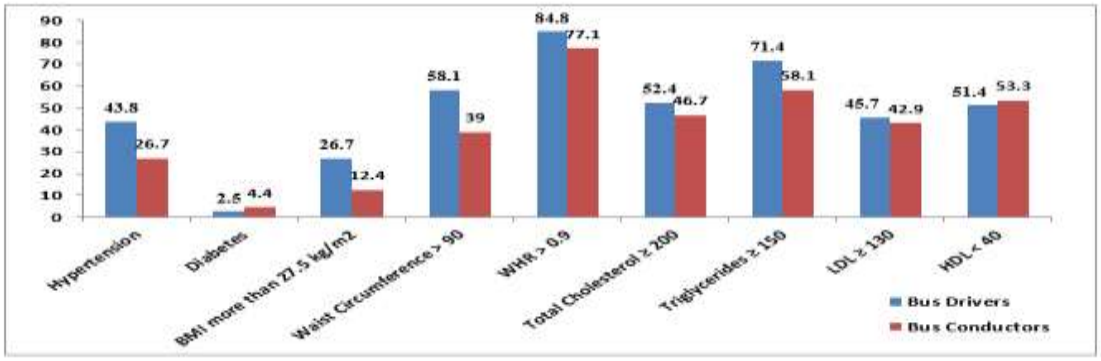

Figure 2: CVD risk factors among study participants in percentages.

Table 4: Odds ratio for risk factors of CVD and CVD risk of bus drivers with bus conductors as referents.

Risk factor of CVD	OR (95% CI)
Behavioural risk factors	
Current tobacco consumption	1.2 (0.6, 2.3)
Current alcohol consumption	1.7 (0.9, 2.8)
Heavy episodic drinking	1.8 (0.8, 4.2)
Inadequate consumption of fruits and vegetables	1.3 (0.6, 2.7)
Additional salt intake	1.5 (0.8, 2.6)
Daily consumption of HFSS foods	1.8 (0.9, 3.5)
Inadequate physical activity	1.4 (0.7, 2.5)
Stress using PSS	
Moderate to severe stress	5.6 (2.3, 13.5)
Hypertension	
Presence of hypertension	2.1 (1.2, 3.8)
>140 or 90 mmHg	1.6 (0.8, 3.2)
Diabetes	
Presence of diabetes	1.7 (0.9, 3.2)
FBSL≥126 mg/dl	1.9 (1.0, 3.4)
HbA1C≥6.5%	1.3 (0.6, 2.6)
Obesity	
BMI ≥27.5 kg/m^2	2.6 (1.3, 5.3)
WC>90 cm	1.5 (1.1, 2.0)
WHR>0.9	0.6 (0.3, 1.2)
Dyslipidemia	
Total cholesterol≥200 mg/dl	1.3 (0.7, 2.2)
LDL cholesterol≥130 mg/dl	1.1 (0.7, 1.9)
HDL cholesterol<40 mg/dl	0.9 (0.5, 1.6)
Triglycerides≥150 mg/dl	1.8 (1.0, 3.2)
CVD risk (intermediate-high)	
FRS-BMI	2.0 (1.2, 3.5)
FRS-lipids	1.7

10 years CVD risk using FRS

Using FRS (BMI), 45 (42.9%) bus drivers had intermediate risk and 22 (20.9%) had high risk. Among bus conductors, 32 (30.5%) had intermediate risk and 17 (16.2%) had high risk and the difference is found to be statistically significant. Whereas using FRS (lipids), 38 (36.2%) bus drivers had intermediate risk and 31 (29.5%) had high risk. Among bus conductors, 38 (36.2%) had intermediate risk and 18 (17.1%) had high risk. (Table 5). The mean vascular ages calculated using FRS-BMI were higher in bus drivers (56.514±13.789) compared to bus conductors (53.923±14.624). Similarly using FRS-lipids, bus drivers had a mean vascular age of 59.742±15.478 years and bus conductors had a mean vascular age of 56.152±15.478 years.

The mean vascular ages were also significantly higher than the chronological ages implying an early vascular ageing or atherosclerosis among bus drivers ($p<0.001$). When Odds ratios were calculated for CVD risk using FRS-BMI and FRS-lipids, it was observed that bus drivers had higher odds of having an increased CVD risk compared to bus conductors (Table 4).

Risk of CVD with respect to duration of service, work-shift pattern and stress

Bus drivers with more than 20 years of service were at a significantly higher risk of having intermediate-high CVD risk and with an OR of 129.5 at 95% CI (20.0, 838.3) using FRS-BMI. Using FRS-lipids the OR was 61.25 at 95% CI (12.5, 300.9). Bus drivers with 24-hour shift pattern were at a significantly higher risk of having intermediate-high CVD risk with an OR of 7.39 at 95% CI (2.6, 21.3). Using FRS-lipids the OR was 11.5 at 95% CI (3.7, 35.1). Those bus drivers having moderate-severe level of stress had higher odds of having intermediate-high CVD risk (OR=1.8 at 95% CI (0.7, 4.7) using FRS-BMI and OR=1.1 at 95% CI (0.4, 2.6).

The bus conductors with longer duration of service, with 24-hour shift pattern and with moderate-severe stress also had significantly higher odds for CVD risk; however, the ORs were lower than that of bus drivers.

Table 5: Distribution of study participants according FRS

CVD risk	Bus drivers		Bus conductors		Total	
	N	%	N	%	%	N
Using FRS-BMI						
Low	38	36.2	56	53.3	94	48.8
Intermediate	45	42.9	32	30.5	77	36.6
High	22	20.9	17	16.2	39	18.6
Total	105	100	105	100	210	100
χ^2=6.283, df=2, p value=0.043						
Using FRS-lipids						
Low	36	34.3	49	46.7	85	40.5
Intermediate	38	36.2	38	36.2	76	36.2
High	31	29.5	18	17.1	49	23.3
Total	105	100	105	100	210	100
χ^2=5.437, df=2, p value=0.066						

DISCUSSION

Nasri et al, found the mean systolic and mean diastolic BP to be significantly higher in bus drivers. They also reported that bus drivers have 5.79 times higher odds of being hypertensive compared to controls.[14] In a study by Imran et al, the mean heart rate showed significant change after driving hours and also when compared to bus conductors at the end of working hours.[21] This may be the reason why more the bus drivers in the present study had significantly higher mean heart rate when compared to bus conductors. Aslam et al, compared bus drivers with bus conductors in Multan, Pakistan reported 62.5% bus drivers were overweight compared to 32.4% bus conductors, similar to our study. Also, more bus drivers had a waist circumference ≥94 cm compared to bus conductors.[22] Nasri et al also reported bus drivers to have significantly higher mean levels of cholesterol, LDL and triglycerides and lower mean HDL levels when compared to controls.[14]

A study done in the city of Teresina, using FRS-CHD risk score however showed a lower proportion of bus drivers to have increased CVD risk (15%).[23] A study done in Korea, comparing professional bus drivers with other occupations; found that significantly higher proportion of bus drivers (54.3%) were having intermediate to high risk compared to other groups (28.9%).[24] Lakshmi et al used the WHO-ISH (without blood cholesterol) risk prediction charts and waist to height ratio to assess CVD risk in bus drivers of KSRTC in Karnataka and reported, 10% to have moderate to very high risk and based on waist to height ratio 66% had moderate and 12% had high risk of CVD development. However, WHO-ISH has lower accuracy in Indian settings compared to FRS.[25-27] A study by Hedberg et al who used the cardiovascular risk index found that the odds ratio for having a high score on cardiovascular risk index was 3.18 (95% CI 2.41-4.2) for the drivers and comparison with the referents.[28]

CONCLUSION

In our study the risk factors of CVD and the 10-years CVD risk estimated using FRS were higher among bus drivers of the STU in comparison to the bus conductors. The bus drivers and bus conductors were similar with respect to socio-demographic and work-related characteristics, except for the task of driving a bus by a bus driver. However, because of the cross-sectional design of the study, the increased CVD risk in bus drivers cannot be interpreted as causal with respect to occupation of bus driving. A longitudinal study would be needed to overcome these limitations and conclude causal relationships.

Recommendations

Awareness regarding cardiovascular health among bus drivers and bus conductors is necessary. Bus drivers' health should be regularly monitored by periodic health check-ups to enable early detection of CVD. In addition to limitation of weekly and daily working hours, there should be adequate periods of rest between bus trips and adequate time for proper meals.

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