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Research article

Prevalence and lifestyle-related risk factors of obesity and unrecognized hypertension among bus drivers in Ghana

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ABSTRACT

Obesity and hypertension are public health problems associated with cardiovascular events worldwide. Bus drivers, whose lifestyle is primarily sedentary and characterized by poor eating habits are at increased risk. This study determined the prevalence and lifestyle-related risk factors of obesity and hypertension among Inter-Regional Metromass Bus Drivers (IRMBDs) in Ghana. This cross-sectional study recruited 527 professional drivers from Metromass Bus stations in Accra and Kumasi Metropolis, Ghana. Structured questionnaires were administered to obtain socio-demographic and lifestyle characteristics from all participants. Anthropometric measurements including body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR) and blood pressure (BP) were determined. The prevalence of unrecognized hypertension was 38.7%. The prevalence of obesity using BMI, WC, and WHR as obesity indices were 19.0%, 19.9%, and 19.4%, respectively. Use of sleep inhibitors, long-duration sitting and eating late at night were independent risk factors for obesity, regardless of the obesity index used ($p < 0.05$). Physical inactivity, high caloric intake and eating at stressful periods were independent risk factors for obesity based on WC and WHR measurements ($p < 0.05$). Ageing, smoking history, alcoholic beverage intake, sleep inhibitor drug use, high calorie intake, long-duration sitting, eating late and under stressful conditions were independent risk factors for hypertension ($p < 0.05$). There is a high prevalence of unrecognized hypertension and obesity among IRMBDs which were associated with individual lifestyle and behaviours. Increased awareness through educational and screening programs will trigger lifestyle modifications that will reduce cardio-metabolic disease onset and offer clues for better disease predictive, preventive and personalized medicine.

1. Introduction

Hypertension is the commonest risk factor for cardiovascular diseases and it is associated with many morbidities and mortalities worldwide [1]. In low-and-middle income countries and sub-Saharan Africa (SSA), about 46% of the people currently have hypertension [2]. More disturbing are those having subclinical disease, also known as suboptimal health [3, 4]. This state is defined as an intermediate between health and chronic disease, such as hypertension, and characterized by perceived body weakness and lack of vitality [5, 6].

The National Health and Nutrition Examination Survey (NHANES) has revealed that 1 out of 3 US adults has hypertension, and about 48.2% of these individuals do not have their blood pressure under control. Further investigations on the population with uncontrolled blood pressure indicated that 36.2% were neither aware of their hypertension nor on any antihypertensive drugs [7]. This suggests that millions of individuals with uncontrolled hypertension are being seen each year, even by healthcare professionals but remain unrecognized/undiagnosed, thus “hiding in plain sight” [8]. One such category of people is long-distance commercial bus drivers [9, 10, 11].

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Studies have revealed the existing synergy between overweight/obesity and hypertension in relation to chronic diseases and cardiovascular complications [12, 13]. Like all other metabolic abnormalities, obesity is common among people who overeat and live sedentarily with little or no exercise [14]. Many bus drivers resort to eating fast foods, snacks and alcoholic beverages from hotels after long or extended periods of driving with little or no physical activity [15, 16]. For example, in 2013, Abban reported that the prevalence of overweight and obesity among commercial long-distance bus drivers was 24.7% and 5.8% respectively [17].

Although this study has indicated this association, this is the first attempt to explore simultaneously, the link between obesity, unrecognized hypertension and lifestyle behavior among IRMBDs in Ghana. Early recognition of at-risk individuals will promote timely intervention and fuel the efforts of cardiovascular disease predictive, preventive and personalized medicine [18].

2. Materials and methods

2.1. Study design and settings

This cross-sectional study was conducted from January 2015 to May 2016 at Metromass transit stations in Accra and Kumasi Metropolis. In both cities are business centres, industries, markets, hospitals and schools amongst others. The Metromass transit is a state-owned company that transports people from a station to different destinations all over the country.

2.2. Selection of study participants

A randomized sampling technique was used to recruit eligible participants for this study. A total of 527 IRMBDs who travelled over 200km/day participated in the study. Structured questionnaires were administered to obtain information on socio-demographic characteristics (such as age, marital status, level of education, average income, ethnicity, family history of hypertension and obesity) and lifestyle-related factors (such as physical activity, sedentary behaviour, long duration in a sitting position, high-calorie diet, alcohol intake, use of sleep-inhibiting drugs and smoking).

2.3. Inclusion/exclusion criteria

Bus drivers who had a professional driver's license from the Drivers and Vehicle Licensing Authority (DVLA) and were fully active for work were included. Those with a history of hypertension or anti-hypertension medication use were excluded.

2.4. Ethics approval and consent to participate

The Committee on Human Research Publications and Ethics (CHRPE) at the KNUST School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, the Human Research Ethics Committee of Edith Cowan University (ECU) and the Ethical Committee of the Metromass Bus Transport approved this study. Participation was voluntary and written informed consent was obtained from each participant. All information obtained from participants were kept under strict confidentiality.

2.5. Blood pressure measurement

Blood pressure measurement was performed with an automatic validated device (Omron HEM711DLX, UK) on the upper left arm in a sitting position with the legs uncrossed and the arm supported at the height of the heart and a cuff adapted to the arm size. Blood pressure was measured after each participant had rested for at least 10 min. Measurements were repeated twice and the average systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded. Unrecognized hypertension was defined as systolic pressure levels ≥140 mmHg and/or diastolic levels ≥90 mmHg according to the National High Blood Pressure Education Program guideline (2000).

2.6. Anthropometric measurements

2.6.1. Weight and height

Participants were made to stand without their sandals, bags or anything of significant weight on the weighing scale (Seca, Hamburg, Deutschland) and against the Stadiometer (Seca, Hamburg, Deutschland). The weight was read to the nearest 0.1 kilogram and recorded. The value for the height was recorded to the nearest 0.1 centimetres and then converted to metres. The body mass index (BMI) was calculated using the formula BMI = (weight/height^2) and expressed in kg/m^2.

2.6.2. Waist circumference (WC) and hip circumference

Gulick II spring-loaded measuring tape (Gay Mills, WI) was used to measure waist circumference between the inferior angle of the ribs and the suprailiac crest whereas hip circumference was measured at the outermost points of the greater trochanters. WHR was calculated and recorded to the nearest two decimal places.

2.7. Definition of anthropometric terms

Using the current World Health Organization (WHO) criteria, BMI (kg/m^2) was defined as underweight, normal, overweight, and obese based on the following categories: BMI of <18.5 kg/m^2, 18.5–24.9 kg/m^2, 25–29.9 kg/m^2, and 30 kg/m^2, respectively [20]. Waist circumference (WC) specific for males was defined as normal (WC < 94cm), overweight (94–101.9cm), and obese (≥102 cm) whereas waist to hip ratio (WHR) specific for males was also defined as normal (<0.90), overweight (0.90–0.99), and obese (≥1.0) [20,21].

2.8. Statistical analysis

The data entry and analysis were performed using the IBM statistical package for social science (SPSS) version 20. Descriptive statistics such as frequencies, percentage and charts were used. Chi-square or Fischer's exact test statistical methods were used to determine the association between categorical variables. Logistic regression analyses were performed to determine risk factors of obesity and hypertension. Tests of statistical significance (i.e. $P < 0.05$) were reported based on two-tailed probability.

3. Results

Table 1 shows the socio-demographic characteristics of study participants. The mean age of participants was 44.07 years and the most represented age group was 40–49 years (39.0%), followed by 30–39 years (32.0%), 50–59 years (23.8%) and 60–69 years (4.8%). A higher proportion of the participants were married (91.1%), had completed basic education (78.1%), earned middle income salary (61.9%), and were Akan (49.1%) by ethnicity. Few participants were single (2.3%), had no formal education (0.1%), earned high income (14.3%) and Ewe (5.1%) by ethnicity. The proportions of participants with a family history of hypertension and obesity were 18.4% and 26.4% respectively.

Table 2 shows that a higher proportion of participants drank alcoholic beverages (50.5%). Out of this proportion, 38.1% drank 1–2 bottles of alcoholic content per day while 12.4% drank 2–4 bottles of alcoholic content per day. A higher number of participants 452 (85.7%) were non-smokers, 10 (1.9%) were current smokers while 65 (12.4%) were former smokers. A higher proportion (75.2%) of participants were physically inactive while 24.9% engaged in regular exercise. Among the regular exercise group, 16.2% did very light exercise, 6.7% did moderate exercise and 1.9% did regular active exercise. Additionally, a higher

Table 1. Socio-demographic characteristics of general study participants.

Variables	Frequency	Percentages
Age (years) (Mean ± SD)	44.07 ± 9.29	
Age Group (year)		
30–39	171	32.4%
40–49	206	39.0%
50–59	125	23.8%
60–69	25	4.8%
Marital Status		
Single	12	2.3%
Married	480	91.1%
Divorced	20	3.8%
Widower	15	2.9%
Level of Education		
No formal education	5	0.1%
Basic	412	78.1%
Secondary	80	15.2%
Tertiary	30	5.7%
Average income (GH₵)		
Low (<500.0)	125	23.8%
Middle (500–999.0)	326	61.9%
High (≥1000.0)	75	14.3%
Ethnicity		
Akan	259	49.1%
Ewe	27	5.1%
Ga-Adangbe	203	38.5%
Northerners	38	7.2%
Family history of hypertension		
Yes	97	18.4%
No	430	81.6%
Family history of obesity		
Yes	139	26.4%
No	388	73.6%

Table 2. Lifestyle characteristics of study participants.

Variables	Frequency	Percentages
Smoking History		
Current smoker	10	1.9%
Former smoker	65	12.4%
Non-smokers	452	85.7%
Alcoholic beverage intake		
Current intake	266	50.5%
Former intake	65	12.4%
No	196	37.1%
Current intake *(No. of bottles per day)*		
1-2bottles	201	38.1%
2-4bottle	65	12.4%
Regular physical exercise		
Yes	131	24.9%
No	396	75.1%
Physical activity		
Active	10	1.9%
Moderate	35	6.7%
Light	86	16.3%
Sleep inhibitors usage		
current user	85	16.2%
former user	10	1.9%
No	432	81.9%
High calorie intake		
Yes	481	91.3%
No	5	8.7%
Ate whilst driving		
Yes	431	81.8%
No	96	18.2%
Ate under stressful conditions		
Yes	298	56.5%
No	229	43.5%
Ate at late-night hours		
Yes	215	40.8%
No	312	59.2%

percentage (81.9%) of the participants never used sleep inhibitors, 16.2% were current users while 1.9% were former users. A higher proportion of participants ate high-calorie foods (91.3%), ate whilst driving (81.8%), and ate under stressful conditions (56.5%). Approximately, 41% ate at late hours.

Logistic regression analysis indicates that current sleep inhibitors use [aOR = 2.41; 95% CI (1.38 to 4.19); p = 0.0025], long-duration sitting whilst eating [aOR = 2.15; 95% CI (1.17 to 3.93); p = 0.0134] and eating late at night [aOR = 1.71; 95% CI (1.07 to 2.76); p = 0.0320?] were independent risk factors for obesity when BMI was used as the obesity index and after adjusting for age, ethnicity and family history of obesity. The prevalence of obesity, overweight, and normal weight were 19.0% (100/527), 35.3% (186/527), and 45.7% (230/527) respectively using BMI as an obesity index (Table 3).

Using WC as an obesity index, physical inactivity [aOR = 3.91; 95% CI (1.71 to 8.94); p = 0.0003], current sleep inhibitor use [aOR = 3.28; 95% CI (1.89 to 5.70); p < 0.0001], high calorie intake [aOR = 6.05; 95% CI (1.40 to 26.02); p = 0.0044], long-duration sitting whilst eating [aOR = 3.36; 95% CI (1.73 to 6.52); p < 0.0001], eating under stressful conditions [aOR = 2.36; 95% CI (1.41 to 3.95); p = 0.0010] and eating late at night [aOR = 2.49; 95% CI (1.54 to 4.02); p = 0.0003] were independent risk factors for obesity after adjusting for age, ethnicity and family history of obesity on logistic regression analysis. Using WC as an obesity index, prevalence of obesity, overweight and normal weight were 19.9% (105/527), 34.9% (184/527) and 45.2% (238/527) respectively (Table 4).

Using WHR as an obesity index, physical inactivity [aOR = 5.92; 95% CI (2.29 to 15.3); p < 0.0001], current sleep inhibitor use [aOR = 3.08; 95% CI (1.77 to 5.35); p < 0.0001], high calorie intake [aOR = 5.43; 95% CI (1.25 to 23.47); p = 0.0115], long-duration sitting whilst eating [aOR = 3.98; 95% CI (1.96 to 8.09); p < 0.0001], eating under stressful conditions [aOR = 2.50; 95% CI (1.47 to 4.26); p = 0.001] and eating late at night [aOR = 2.83; 95% CI (1.73 to 4.65); p < 0.0001] were independent risk factors for obesity after adjusting for age, ethnicity and family history of obesity on logistic regression analysis. Using WHR, the prevalence of obesity, overweight and normal weight were 19.4% (102/527), 36.1% (190/527) and 44.6% (235/527) respectively (Table 5).

Logistic regression analysis indicated that age group 50–59 years [aOR = 5.43; 95% CI (3.20 to 9.21); p < 0.0001], 60–69 years [aOR = 5.09; 95% CI (2.12 to 12.25); p = 0.0004], current smokers [aOR = 7.09; 95% CI (1.48 to 33.81); p = 0.0066], former smokers [aOR = 1.83; 95% CI (1.08 to 3.08); p = 0.0128], alcoholic beverage intake [aOR = 3.19; 95% CI (2.13 to 4.76); p < 0.0001], current sleep inhibitor use [aOR = 3.24; 95% CI (2.00 to 5.25); p < 0.0001], high calorie intake [aOR = 2.43; 95% CI (1.18 to 5.02); p = 0.0167], long-duration sitting whilst eating [aOR = 3.87; 95% CI (2.18 to 6.83); p < 0.0001], eating under stressful conditions [aOR = 4.68; 95% CI (3.14 to 6.96); p < 0.0001] and eating late at night [aOR = 8.17; 95% CI (5.49 to 12.17); p < 0.0001] were independent risk factors for unrecognized hypertension after adjusting for age, ethnicity and family history of hypertension. 204 of the total 527 participants, representing 38.7% had high blood pressure while 61.3% (323/527) of the participants were normotensive (Table 6).

Table 3. Association between lifestyle characteristics and obesity classified by BMI.

Variables	Total	BMI			Obesity	*p-value*
		Normal	Overweight	Obese	aOR(95%CI)	
		N = 241	N = 186	N = 100		
Smoking History						
Current smoker	10	5(2.1%)	3(1.6%)	2(2.0%)	0.94(0.18 to 4.98)	0.983
Former smoker	65	25(10.4%)	31(16.7%)	9(9.0%)	0.85(0.38 to 1.90)	0.843
Non-smokers	452	211(87.5%)	152(81.7%)	89(89.0%)	1.0	
Alcoholic intake						
Current intake	266	128(53.1%)	90(48.4%)	48(48.0%)	0.71(0.43 to 1.18)	0.198
Former intake	65	35(14.5%)	19(10.2%)	11(11.0%)	0.60(0.27 to 1.29)	0.262
No	196	78 (32.4%)	77(41.4%)	41(41.0%)	1.0	
Regular Exercise						
Yes	131	42(17.4%)	72(38.7%)	17(17.0%)	1.0	
No	396	199(82.6%)	114(61.3%)	83(83.0%)	1.01(0.55 to 1.91)	0.6181
Sleep inhibitors usage						
current user	85	37(15.4%)	18(9.7%)	30(30.0%)	2.41(1.38 to 4.19)	0.0025
former user	10	5(2.1%)	2(1.1%)	3(3.0%)	1.78(0.41 to 7.66)	0.4252
No	432	199(82.6%)	166(89.2%)	67(67.0%)	1.0	
High calorie intake						
Yes	481	216(89.6%)	178(95.7%)	87987.0%)	0.77(0.37 to 1.58)	0.5708
No	46	25(10.4%)	8(4.3%)	13(13.0%)	1.0	
Ate whilst driving						
Yes	431	171(70.9%)	176(94.6%)	84(84.0%)	2.15(1.17 to 3.93)	0.0134
No	96	70(29.1%)	10(5.4%)	16(16.0%)	1.0	
Ate under stressful conditions						
Yes	298	143(59.3%)	89(45.4%)	66(66.0%)	1.33(0.81 to 2.16)	0.2732
No	229	98(40.7%)	97(54.6%)	34(34.0%)	1.0	
Ate at late-night hours						
Yes	215	115(47.8%)	39(21.0%)	61(61.0%)	1.71(1.07 to 2.76)	0.0320
No	312	126(52.3%)	147(79.0%)	39(39.0%)	1.0	

Values are presented as frequency (percentage). $p < 0.05$ was considered as statistically significant level. aOR: adjusted odds ratio; CI: Confidence interval. Logistic regression was adjusted for age, ethnicity and family history of obesity. 1: reference category.

4. Discussion

The prevalence and associated risk factors for cardiovascular and metabolic abnormalities such as hypertension and obesity differ by race, population, condition and occupation [19]. This study determined the prevalence and risk factors for obesity and unrecognized hypertension among inter-regional Metromass bus drivers in Ghana. Overall, the prevalence of obesity based on BMI, WC and WHR indicators was 19.0%, 19.9% and 19.4% respectively. When compared to other studies reported among other populations worldwide, the prevalence of obesity based on BMI definition is low in the present study. In a cross-sectional study among professional bus drivers in São Paulo State, the prevalence of obesity based on BMI was 36% [20]. Similarly, a cross-sectional study by Aguilar-Zinser et al. [21], among professional bus drivers in Mexico yielded a prevalence rate of 22.5% when BMI was used as a measure of obesity. Thus, the low prevalence of obesity in this study compared to previous studies could be due to differences in sample size, ethnicity, environment, diet, nutrition and climate [22]. Comparatively, this cross-sectional study was among an African population and recruited a larger sample size of inter-regional bus drivers while cross-sectional studies among Mongolian [20] and Europeans populations [21] used a smaller sample size.

Compared to BMI indicators, the prevalence of obesity based on WC and WHR indicators was 0.9% and 0.4% higher respectively. This is consistent with the findings by several cross-sectional studies [23, 24, 25] who observed a higher prevalence of obesity when WC and/or WHR were used as obesity measures compared to BMI. This confirms the evidence that increased WC is a stronger indicator of obesity risk compared to BMI [23, 26]. BMI is currently been considered as an insufficient measure of obesity as it does not correctly identify individuals with excess body fat due to its inability to differentiate fat and fat-free mass and it does not account for the effect of age and ethnicity on body fat distribution [27]. An increase in muscle or fat-free mass would, however, be reflected in the central obesity measures [28].

Accumulated evidence from previous study have indicated that lifestyle factors are associated with an increased risk of obesity and cardiovascular outcomes [29]. In this present study, a cluster of lifestyle factors such as sleep inhibitor drug use, prolonged sitting duration whilst eating, and eating late at night were significant independent risk factors when WC, WHR or BMI were used as obesity measures. However, the predictive odds generated by these lifestyle-related factors were significantly higher when WC and WHR were used as obesity measures compared to BMI, which supports the reports that abnormal central obesity measures are better indicators of high cardiovascular risk [26].

The finding of the present study which inidicated that sleep inhibitor drug usage by bus drivers is an independent risk factor of obesity is not well understood. Previous cross-sectional studies have found that sleep deprivation may predispose an individual to weight gain [30]. Self-reported short sleep of less than 7 h per night and experimental sleep deprivation has been linked to metabolic dysregulation on appetite, which is likely to be driven by increased activity in neuronal populations expressing the excitatory peptides orexins that promote both waling and uncontrolled feeding [31].

Another finding of the present study was the association between late-night eating and obesity. This concurs with cross-sectional studies conducted among Brazilian bus drivers [32] as well as in general adult

Table 4. Association between lifestyle characteristics and obesity classified by WC.

Variables	Total	WC			Central obesity	*p-value*
		Normal	Overweight	Obese	aOR(95%CI)	
		N = 238	N = 184	N = 105		
Smoking History						
Current smoker	10	4(1.7%)	3(1.6%)	3(2.8%)	1.69(0.37 to 7.72)	0.983
Former smoker	65	24(10.1%)	33(17.9%)	8(7.6%)	0.75(0.33 to 1.74)	0.552
Non-smoker	452	210(88.2%)	148(80.5%)	93(88.6%)	1.0	
Alcoholic intake						
Current intake	266	128(53.8%)	88(47.8%)	50(47.6%)	0.62(0.38 to 1.00)	0.061
Former intake	65	34(14.3%)	24(13.1%)	7(6.7%)	0.33(0.13 to 0.79)	0.013
No	196	76(31.9%)	72(39.1%)	48(45.7%)	1.0	
Regular Exercise						
Yes	131	52(21.8%)	72(39.1%)	7(6.7%)	1.0	
No	396	186(78.2%)	112(60.9%)	98(93.3%)	3.91(1.71 to 8.94)	0.0003
Sleep inhibitors usage						
current user	85	32(13.4%)	18(9.8%)	35(33.3%)	3.28(1.89 to 5.70)	<0.0001
former user	10	5(2.1%)	2(1.1%)	3(2.9%)	1.80(0.42 to 7.73)	0.4224
No	432	201(84.5%)	164(89.1%)	67(63.8%)	1.0	
High calorie intake						
Yes	481	213(89.5%)	165(89.7%)	103(98.1%)	6.05(1.40 to 26.02)	0.0044
No	46	25(10.5%)	19(10.3%)	2(1.9%)	1.0	
Ate whilst driving						
Yes	431	166(69.7%)	172(93.5%)	93(88.6%)	3.36(1.73 to 6.52)	<0.0001
No	96	72(30.3%)	12(6.5%)	12(11.4%)	1.0	
Ate under stressful condition						
Yes	298	137(57.6%)	81(44.0%)	80(76.2%)	2.36(1.41 to 3.95)	0.001
No	229	101(42.4%)	103(56.0%)	25(23.8%)	1.0	
Ate at late-night hours						
Yes	215	106(44.5%)	39(21.2%)	70(66.7%)	2.49(1.54 to 4.02)	0.0002
No	312	132(55.5%)	145(78.8%)	35(33.3%)	1.0	

Values are presented as frequency (percentage). $p < 0.05$ was considered as statistically significant level. aOR: adjusted odds ratio; CI: Confidence interval. Logistic regression was adjusted for age, ethnicity and family history of obesity. 1: reference category.

populations [33, 34]. Most often, IRMBDs consume high calorie and fatty foods before sleep and these foods disrupt digestion that in turn affects sleep quality and leads to obesity [35].

In the present study, not only eating late hours at night but also, prolonged sitting duration coupled with eating was an independent risk factor for obesity. In a cross-sectional study among Brazilian interstate bus drivers, long duration in a sitting position was a significant predictor of cardiovascular risk factors such as, hypertension, obesity, and dyslipidemia [36], which is consistent with our present study. Several cross-sectional studies have also linked long sitting duration to obesity [37, 38, 39]. Not breaking in-between long sitting duration is a typical example of sedentary habit which has been associated with metabolic syndrome.

Physical inactivity was shown to be an independent risk factor for obesity when both WC and WHR, but not BMI, were used as obesity measures (Tables 4 and 5). This confirms the significance of incorporating WC and WHR when assessing obesity. For physical inactivity, it was not surprising that a high proportion of the IRMBDs had not engaged in vigorous physical exercise in this present study. A previous cross-sectional study by Hirata et al. [36] among Brazilian bus drivers indicated that low-intensity physical activity increased their risk of being obese. In our interview with IRMBDs, the majority preferred to use the bus on errands for short distances instead of walking because it was a quicker means of transportation. It has been suggested that physical inactivity may increase voluntary food intake and reduced metabolic rate consequent to obesity [40].

Aside obesity, hypertension has been a major public health concern due to its adverse health events. Several studies have shown that most commercial workers are unaware of their elevated blood pressure and as such suffer from chronic undiagnosed hypertension [41, 42]. Early recognition and identification of early risk of cardiovascular risk factors such as hypertension at the suboptimal health phase [43] will inform the decision for predictive, preventive and personalized medicine [44].

In the present study, the prevalence of unrecognized hypertension among Ghanaian IRMBDs in this study was 38.7%. This is comparable to other cross-sectional studies elsewhere, for example, a prevalence rate of 41.3% was identified among bus drivers in North Kerala, India [45], 38.7% amongst long-distance bus drivers in Abha city, Saudi Arabia [46] and 33.5% among commercial bus drivers in Sokoto state, Nigeria [47]. Another cross-sectional study had a slightly lower prevalence rate; 16.0% among bus drivers in Bangalore city, India [48]. The possible explanation for these discrepancies in prevalence rate could be the differences in sample size, environmental, diet, ethnic diversity and lifestyle habits among others. This higher prevalence of hypertension among bus drivers in the present study may be influenced by the psychological and physical stress as a result of long-distance driving [49].

Logistic regression analysis indicated that the elderly IRMBDs (aged 50–59 years and 60–69 years) were 5 times increased odds of developing hypertension. Our finding is consistent with a cross-sectional study by Erhiano et al. [47], among bus drivers in a Nigerian population. In their study, bus drivers falling between ages 50–59 years and 60–70 years were 4 times increased odds of hypertension. Cardiovascular risk factors, especially hypertension has been reported to increase with ageing among several cross-sectional studies [50]. The relationship between ageing and hypertension is expected because ageing is an unavoidable part of life that goes along with physiologic decline across several organ systems,

Table 5. Association between lifestyle characteristics and obesity classified by WHR.

Variables	Total	WHR			Obesity	p-value
		Normal	Overweight	Obese	aOR(95%CI)	
		N = 235	N = 190	N = 102		
Smoking History						
Current smoker	10	5(2.1%)	4(2.1%)	1(0.9%)	0.45(0.05 to 3.95)	0.672
Former smoker	65	21(8.9%)	35(18.4%)	9(8.8%)	0.97(0.43 to 2.20)	0.997
Non-smoker	452	209(88.9%)	151(79.5%)	92(90.2%)	1.0	
Alcoholic intake						
Current intake	266	127(54.1%)	88(46.3%)	51(50.0%)	0.64(0.39 to 1.04)	0.08
Former intake	65	33(14.0%)	25(13.2%)	7(6.9%)	0.34(0.14 to 0.83)	0.09
No	196	75(31.9%)	77(40.5%)	44(43.1%)	1.0	
Regular Exercise						
Yes	131	55(23.4%)	71(37.4%)	5(4.9%)	1.0	
No	396	180(76.6%)	119(62.6%)	97(95.1%)	5.92(2.29 to 15.3)	<0.0001
Sleep inhibitors intake						
current user	85	33(14.0%)	18(9.5%)	34(33.3%)	3.08(1.77 to 5.35)	<0.0001
former user	10	5(2.1%)	3(1.6%)	2(2.0%)	1.19(0.23 to 6.30)	0.981
No	432	197(93.8%)	169(88.9%)	66(64.7%)	1.0	
High calorie intake						
Yes	481	212(90.2%)	169(88.9%)	100(98.0%)	5.43(1.25 to 23.47)	0.0115
No	46	23(9.8%)	21(11.1%)	2(2.0%)	1.0	
Ate whilst driving						
Yes	431	164(69.8%)	175(92.1%)	92(90.2%)	3.98(1.96 to 8.09)	<0.0001
No	96	71(30.2%)	15(7.9%)	10(9.8%)	1.0	
Ate under stressful conditions						
Yes	298	136(57.9%)	83(43.7%)	79(77.5%)	2.50(1.47 to 4.26)	0.0005
No	229	99(42.1%)	107(56.3%)	23(22.5%)	1.0	
Ate at late-night hours						
Yes	215	105(44.7%)	39(205%)	71(69.6%)	2.83(1.73 to 4.65)	<0.0001
No	312	130(55.3%)	151(79.4%)	31(30.4%)	1.0	

Values are presented as frequency (percentage). $p < 0.05$ was considered as statistically significant level. aOR: adjusted odds ratio; CI: Confidence interval Logistic regression was adjusted for age, ethnicity and family history of obesity. 1: reference category.

high suboptimal health and increased disease state [51]. All these together may be a probable explanation for our finding.

In the present study, current smokers were 7 times whereas former smokers were 1.8 times at increased odds of hypertension. This finding is consistent with a cross-sectional study among occupational bus drivers in Nagpur city, Central India. Previous studies have indicated that current smokers are at higher risk of hypertension than former smokers even though former smoking is a risk factor for hypertension [52]. The abrupt noxious effect of smoking is linked to the nervous system overactivity, which upregulates myocardial oxygen influx. This results in increased blood pressure, myocardial contractility and heart rate [53]. Also, chronic cigarette smoking induces arterial stiffness which may persist even after smoking cessation [54].

In the present study, there was a significant independent association between hypertension and alcoholic beverage consumption, sleep inhibitor drug use, high caloric intake, prolonged-sitting whilst eating, eating under stressful conditions and eating at late hours at night. These findings are similar to that reported in a cross-sectional study among Bus Drivers Brazil [36].

Particularly, alcohol consumption and its association with hypertension among bus drivers in this present study can be a detrimental risk for road accidents amidst other [55]. The mechanism that underlies alcohol consumption and hypertension are numerous. Alcohol induces hypertension by stimulating cortisol secretion, increasing angiotensin II through the Renin-angiotensin-aldosterone system, and disturbing the sympathoadrenal function [56].

Consistent with previous studies [57, 58] we found a strong association between sleep inhibitor drug use and hypertension among IRBDs. Their relationship between sleep deprivation and hypertension in this study is not self-understood. However, prolonged sleep deprivation may be associated with increased heart rate, increase salt retention and elevated sympathetic nervous system activity, which entrains the cardiovascular system to operate under high pressure [59].

A cross-sectional study have reported that long journey bus drivers eat in highway restaurants that offer fast foods with high-calorie content and low nutritional values [60]. High-calorie food consumption has been associated with hypertension [60], and this agrees with this present study as high calories food consumption by bus drivers was an independent predictor of hypertension.

Prolonged sitting duration coupled with eating, eating under stressful condition, and eating at late hours is lifestyle modifiable factors that contribute to cardiovascular events, especially hypertension and obesity [61]. Our present study found these factors as independent risk factors of hypertension. During the interview period with our study participants, we found that majority of the long journey bus driver work for several hours to gain extra income to support themselves and family; in doing this they end up working under stress, eating under stress and at late hours midnight.

In general, there was a high prevalence of obesity and unrecognized hypertension among the participants. This calls for immediate action as these people could be given health advice on lifestyle modifications and cost-effective treatments that can postpone the onset of hypertension and other metabolic related co-morbidities. This attempt would not only drive the integrative concept of predictive, preventive and personalized medicine but would also set the scene for advanced healthcare that will promote a paradigm change from disease to wellness [62].

Table 6. Association between lifestyle characteristics and unrecognized hypertension.

Variables	Total	BP		aOR(95%CI)	p-value
		Normal n = 323	High n = 204		
Age Group (year)					
30–39	171	141(43.6%)	30(14.7%)	1.0	
40–49	206	112(34.7%)	94(46.1%)	1.49(0.44 to 3.37)	0.0801
50–59	125	58(18.0%)	67(32.8%)	5.43(3.20 to 9.21)	<0.0001
60–69	25	12(3.7%)	13(6.4%)	5.09(2.12 to 12.25)	0.0004
Smoking History					
Current smoker	10	2(0.6%)	8(3.9%)	7.09(1.48 to 33.81)	0.0066
Former smoker	65	32(9.9%)	33(16.2%)	1.83(1.08 to 3.08)	0.0283
Non-smoker	452	289(89.5%)	163(79.9%)	1.0	
Alcoholic intake					
Current intake	266	129(39.9%)	137(67.2%)	3.19(2.13 to 4.76)	<0.0001
Former intake	65	47(14.6%)	18(8.8%)	1.15(0.61 to 2.16)	0.7434
No	196	147(45.5%)	49(24.0%)	1.0	
Regular Exercise					
Yes	131	81(25.1%)	50(24.5%)	1.0	
No	396	242(74.9%)	154(75.5%)	1.03(0.68 to 1.55)	0.9178
Sleep inhibitors usage					
current user	85	32(9.9%)	53(26.0%)	3.24(2.00 to 5.25)	<0.0001
former user	10	5(1.5%)	5(2.5%)	1.96(0.55 to 6.87)	0.3203
No	432	286(88.6%)	146(71.6%)	1.0	
High calorie intake					
Yes	481	287(88.9%)	194(95.1%)	2.43(1.18 to 5.02)	0.0167
No	46	36(11.1%)	10(4.9%)	1.0	
Ate whilst driving					
Yes	431	243(75.2%)	188(58.2%)	3.87(2.18 to 6.83)	<0.0001
No	96	80(24.8%)	16(41.8%)	1.0	
Ate under stressful conditions					
Yes	298	139(43.0%)	159(77.9%)	4.68(3.14 to 6.96)	<0.0001
No	229	184(57.0%)	45(22.1%)	1.0	
Ate at late-night hours					
Yes	215	72(22.3%)	143(70.1%)	8.17(5.49 to 12.17)	<0.0001
No	312	251(77.7%)	61(29.9%)		

Values are presented as frequency (percentage). $p < 0.05$ was considered as statistically significant level. OR: odds ratio; CI: Confidence interval. Logistic regression was adjusted for age, ethnicity and family history of hypertension; 1: reference.

The strength of the present study lies in the inclusion of bus divers from the two largest cities in Ghana (Accra and Kumasi) which are the main depot of Bus Drivers in Ghana, indicating that a fair representation of participants across the sphere of Ghana took part in the study. Despite the significant findings of this study, a few limitations need to be mentioned. The questionnaire used in determining the lifestyle behaviour of participants was subjective and responses were mostly “yes” or “no” without considering the degree of lifestyle activity. Again, we were not able to draw venous blood samples from participants to estimate their biochemical markers, which could have helped explain the extent of the cardio-metabolic risk. Furthermore, because the study was a cross-sectional one, we could not determine the direction of causality, thus the study design limits us to make a generalized conclusion of the present study findings. Therefore, a prospective cohort study is warranted to determine the cardio-metabolic profiling of long-distance bus drivers while including the perspective of preventive, predictive and personalized medicine.

5. Conclusions

There is high prevalence of obesity and unrecognized hypertension among inter-regional Metromass bus drivers. The prevalence of obesity was higher using WC and WHR compared to using BMI. The prevalence of obesity and unrecognized hypertension are attributable to prolonged sitting, late night eating, smoking and physical inactivity. If these characteristics persist, then future cardiovascular outcomes will become inevitable. Therefore, educational programs in the form of routine medical screening and awareness creation will lead to lifestyle modifications that would in turn, mitigate future cardiovascular events.

Declarations

Author contribution statement

E. Anto, W. Owiredu: Conceived and designed the experiments.

E. Adua, C. Obirikorang, L. Ahenkorah Fondjo: Contributed reagents, materials, analysis tools or data.

M. Annani- Akollor, E. Acheampong, E. Adu Asamoah: Performed the experiments.

P. Roberts, W. Wang, S. Donkor: Analyzed and interpreted the data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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