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**ORIGINAL ARTICLE /** *ARTIGO ORIGINAL*

# Factors associated with obesity in urban collective transportation workers of the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil

## *Fatores associados à obesidade em rodoviários da Região Metropolitana de Belo Horizonte, Minas Gerais, Brasil*

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**ABSTRACT:** ***Objective:*** To analyze the demographic, behavioral and occupational factors associated with obesity among urban collective transportation workers of the Metropolitan Region of Belo Horizonte, Minas Gerais State, Brazil. ***Method:*** This is a cross-sectional study conducted with 1,448 drivers and collectors in the Metropolitan Region of Belo Horizonte. Anthropometric, demographic, behavioral data, as well as participants' link to the company and bus conditions were gathered in 2012 through a questionnaire applied by an interviewer. To calculate obesity, the body mass index cut off point was ≥ 30 kg/m². Prevalence ratios (PR) and respective 95% confidence intervals (95%CI) were adjusted by Poisson's multivariate regression. ***Results:*** The prevalence of obesity among urban collective transportation workers was 16.1%. Female sex (PR = 1.84; 95%CI 1.37 – 2.49), aging 30 to 39 years old (PR = 1.66; 95%CI 1.17 – 2.37) and 40 to 49 years old (PR = 1.59; 95%CI 1.04 – 2.42), being in the same job role from 5.01 to 10 years (PR = 1.52; 95%CI 1.04 – 2,42) and from 20.01 to 47 years (PR = 1.90; 95%CI 1.21 – 3.00), and physical inactivity (PR = 1.32; 95%CI 1.01 – 1.73) remained independently associated with obesity after multivariate adjustment data. ***Conclusion:*** These findings highlight the need to consider actions that encourage employees to participate in healthy activities when discussing health promotion for public transport workers, as well as actions to improve the organization and management of work, so it becomes a health and well-being feature for this population.

***Keywords:*** Working conditions. Occupational health. Obesity. Automobile driving.

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**RESUMO:** ***Objetivo:*** Analisar os fatores demográficos, comportamentais e ocupacionais associados à obesidade em trabalhadores do transporte coletivo urbano de cidades da Região Metropolitana de Belo Horizonte (RMBH), Minas Gerais, Brasil. ***Método:*** Estudo transversal com 1.448 motoristas e cobradores da RMBH. Dados antropométricos, demográficos, comportamentais, de vínculo com a empresa e condições do ônibus foram coletados, em 2012, por meio de questionário aplicado face a face por entrevistador. Para o cálculo da obesidade, utilizou-se como ponto de corte o índice de massa corporal ≥ 30 kg/m$^2$. Razões de prevalência (RP) e seus respectivos intervalos de confiança de 95% (IC95%) foram ajustados pela técnica de regressão multivariada de Poisson. ***Resultados:*** A prevalência da obesidade entre os trabalhadores foi de 16,1%. O sexo feminino (RP = 1,84; IC95% 1,37 – 2,49), estar nas faixas etárias dos 30 aos 39 anos (RP = 1,66; IC95% 1,17 – 2,37) e dos 40 aos 49 anos (RP = 1,59; IC95% 1,04 – 2,42), tempo no cargo de 5,01 a 10 anos (RP = 1,52; IC95% 1,04 – 2,42) e 20,01 a 47 anos (RP = 1,90; IC95% 1,21 – 3,00) e inatividade física (RP 1,32; IC95% 1,01 – 1,73) permaneceram independentemente associados à obesidade após o ajuste multivariado dos dados. ***Conclusão:*** Tais achados evidenciam a necessidade de considerar, nas discussões sobre promoção da saúde dos rodoviários, ações que incentivem a participação dos trabalhadores em atividades saudáveis, assim como a melhoria da organização e gestão do trabalho, para que este seja um promotor de saúde e bem-estar nesta população.

***Palavras-chave:*** Condições de trabalho. Saúde do trabalhador. Obesidade. Condução de veículo.

## INTRODUCTION

Obesity is a major public health problem, reaching approximately 650 million adults globally[1]. In Brazil, the proportion of obese individuals in 2017 was 18.9%, and it is higher among men (19.2%) than among women (18.7%)[2].

It is estimated that such morbidity is responsible for 3.4 million deaths per year and 93.6 million years of life lived with disabilities due to a well-known association with chronic noncommunicable diseases (NCDs), such as diabetes mellitus, arterial hypertension, coronary artery disease, stroke, some types of cancer, obstructive sleep apnea and osteoarthritis[3].

In Brazil, over 70% of all deaths per year are attributed to NCDs, which makes them the most prominent public health problem[3], with high social and economic burden on the country. The economically active population (EAP) is affected in large proportions, which generates early retirements due to disability and temporary withdrawals, especially due to cardiovascular diseases[4].

Facing such magnitude and social relevance, researchers' interest in obesity prevention, control and treatment has increased in recent years in an attempt to reduce the impact of morbidity and mortality by NCDs, especially in the EAP.

Unhealthy living habits are associated with obesity[1,5,6], with emphasis to the intake of foods high in energy and in fat[1,5] and physical inactivity[1,6]. However, other associations lack further evidence, especially when involving working conditions. In this context, we seek to estimate the relations between working conditions and obesity among urban collective transportation workers for the reasons described as follows.

First, the prevalence of obesity among urban collective transportation workers has been reported high both by international studies (mean 32%, ranging between 9.6 and 57%)[7-15] and national studies (mean of 24%, ranging from 17.3 to 24.7%)[16-22]. Secondly, although the influence of work environment and process on the occurrence of obesity is well documented[9,10,18,20,23], the theme has not yet been sufficiently explored when it comes to urban collective transportation workers.

This evidence is worrying given the prominent role of collective transport and its protagonists in urban life, including economic growth and development. In addition to the large number of professionals in this group, they have the responsibility of guaranteeing daily mobility of large numbers of passengers[24,25], since buses are the most used means of locomotion by Brazilians in cities[26].

The aim of this study was to analyze the demographic, behavioral and occupational factors associated with obesity among urban collective transportation workers from the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil.

## METHODS

Epidemiological, cross-sectional, analytical study that integrates a broader research entitled "Working conditions and health of urban collective transport workers"[27].

The population eligible for the project was composed of drivers and ticket collectors from the cities of Belo Horizonte, Betim and Contagem, which are part of metropolitan regions of Belo Horizonte, the third largest urban agglomeration in Brazil.

The sample of drivers and collectors of these three cities corresponded to approximately 17,470 workers, as Belo Horizonte was home to about 6,500 drivers and 6,750 collectors; Betim to 696 drivers and 524 collectors; and Contagem to 1,800 drivers and 1,200 collectors. The estimate of Belo Horizonte's quota was based on the ratio of 2.14 drivers/fleet and 2.19 ticket collectors/fleet; the estimates for both Betim and Contagem was based on data provided by companies and workers' unions. A quota proportional to the total number of professionals, stratified by occupation (drivers or collectors) was selected in each city.

Sample size calculation took into consideration the range of outcomes of interest for the study. For this, 4% sample error, 95% confidence interval (95%CI) and 50% prevalence were estimated, resulting in a sample of 565 drivers and 561 collectors. A total of 1,607 urban collective transportation workers (853 drivers and 754 collectors) participated in the study. However, to analyze obesity, 159 subjects were excluded due to loss of weight and height information. Therefore, the final sample consisted of 1,448 workers.

Data collection took place between April and June 2012, in morning and afternoon shifts, in person, and with the help of netbooks. Interviews were conducted at four bus-subway stations in Belo Horizonte and at 35 rest stations of the three cities.

Rest stations, known as comfort spots (CSs), are aimed at the bus stop, when professionals take a break after a 60 or 90-minute journey. The selection of CSs followed productivity criteria (greater number of trips per shift, time between trips and work/fleet

ratio). In the four selected bus-subway stations were in use by 80% of the passengers using the service[28].

The data collection instrument was developed based on specialized literature, as well as previous interviews with union representatives and workers. It should be emphasized that the research procedures had been previously tested in the pilot stage of the study, with 30 participants. In addition, reliability of interviews was assessed by re-applying selected questions from the original questionnaire to the same respondent (12% of participants).

The outcome variable "obesity" was elaborated based on the answer to the following questions of the questionnaire: "What's your weight?" and "What's your height?". It is emphasized that, to the extent that anthropometric measures are self-reported, other studies[29,30] have validated this information by identifying high agreement between self-reported and directly measured data.

Weight and height were used to calculate body mass index (BMI), with the equation BMI = weight (kg)/height$^2$ (m). Thus, people were classified according to BMI categories:

1. <18.5 kg/m$^2$: underweight;
2. 18.5 to 24.9 kg/m$^2$: eutrophic;
3. 25.0 to 29.9 kg/m$^2$: overweight;
4. ≥ 30.0 kg/m$^2$: obesity[31].

The following independent variables were included:

1. demographic: gender (male and female); age (18-29 years, 30-39 years, 40-49 years, ≥50 years); skin color (white, brown/black, yellow/indigenous); marital status [married/stable union, single/divorced/widowed]; number of children (none, 1 to 2, 3 or more); schooling (1-4 years of schooling, 5-7 years of schooling, ≥ 8 years of schooling);
2. behavioral: smoking ("Considering a smoker a person who smokes at least 100 cigarettes, or 5 packs, how do you qualify yourself as?" Non-smokers, former smokers, smokers); physical activity ("How often do you perform physical activities?" Never, once a week, twice or more times a week); cultural activities ["Do you usually participate in cultural activities (cinema, theater, exhibition)?" No, yes]; social activities ["Do you usually participate in social activities (visit to friends, parties, bars)?" No, yes]; alcohol use ["Based on the Cut Down, Annoyed by criticism, Guilty and Eye-opener (CAGE) questionnaire[32]: alcohol dependent, not dependent]; medical diagnosis of insomnia (no, yes);
3. occupational: position (driver/mono-conductor, ticket collector); time in charge (0-2 years, 2.01-5 years, 5.01-10 years, 10.0- 20 years, 20.01-47 years); working hours (morning, afternoon, night, movement – double shift, double shift with half trip); change in working hours (never/rarely, sometimes, often/always); other paid work (no, yes); overtime or double shifts (never/rarely, sometimes, often/always); days off (weekend, day off, other); breaks in working hours (never/rarely, sometimes, often/

always); working for the company during holidays (never/rarely, sometimes, often/always); break for lunch (no, yes); "Three or more times a week, do you have lunch or dinner?" (At home, away from home); body vibration when on the bus (never/rarely, sometimes, often/always); perception of temperature at work (tolerable/uncomfortable, annoying/unbearable).

The bivariate analysis was conducted to evaluate the crude association of independent variables of interest with obesity, using Pearson's $\chi^2$ test. The strength of associations was measured by prevalence ratios (PR) and respective 95%CI, estimated by Poisson regression with robust variance.

In the multivariate analysis, variables presenting statistical significance lower than 20% upon bivariate analysis were considered to elaborate the final model of Poisson regression with robust variance. In the final model selection, a step-by-step strategy was used, with the inclusion of all variables selected during the bivariate analysis in descending order of statistical significance. Variables with p-value $\geq 0.05$ were withdrawn one by one and excluded not affecting the stability of the model. All analyses were conducted in the statistical software Stata version 10.0.

The research was approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais. All participants signed the informed consent form.

## RESULTS

We observed that 16.1% of professionals were classified as obese. In addition, 1.5% of them were sorted as underweight, 38.5% as overweight and 43.9% as eutrophic.

Regarding demographic and behavioral characteristics, most participants were males, aged 18 to 39 years, with brown or black skin, reported to be married or in a stable union, having 1 to 2 children, 8 years or more of studies, usually taking part in social activities and not going on cultural activities. In addition, 15.8% of urban collective transportation workers interviewed were smokers, 13.3% were alcohol dependent, 51.7% did not practice physical activities, and 14.9% had medical diagnosis of insomnia (Table 1).

Females, aged between 30 and 39 or 40 and 49 years, having 1-2 children or 3 and more children, ex-smokers, not practicing any physical activity and reporting a medical diagnosis of insomnia were related to obesity at bivariate level ($p<0.05$) (Table 1).

As for occupational characteristics, a greater proportion of participants were drivers, with seniority of 0 to 2 years in the position, working in the morning shift, never or rarely alternating working hours, without other paid employment, often/always doing overtime or doubled shifts, with days off at the weekend, and never or rarely working for the company on holidays. In addition, most urban collective transportation workers noticed that their body would vibrate when on duty, reported a tolerable or annoying temperature in the bus, enjoyed breaks during the work day, but with restrictions to the

Table 1. Association of demographic and behavioral characteristics with obesity in urban collective transportation workers of the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil, 2012.

| Variables | Population | Obesity | | | |
|---|---|---|---|---|---|
| | n (%) | n (%) | PR | 95%CI | p-value* |
| Gender | | | | | |
| Male | 1,266 (87.4) | 186 (14.7) | 1.00 | - | - |
| Female | 182 (12.6) | 47 (25.8) | 1.75 | 1.32 – 2.32 | < 0.001 |
| Age (years) | | | | | |
| 18 – 29 | 500 (34.5) | 48 (9.6) | 1.00 | - | - |
| 30 – 39 | 475 (32.8) | 91 (19.2) | 1.99 | 1.43 – 2.76 | < 0.001 |
| 40 – 49 | 333 (23) | 73 (21.9) | 2.28 | 1.63 – 3.19 | < 0.001 |
| ≥ 50 | 140 (9.7) | 21 (15.0) | 1.56 | 0.96 – 2.51 | 0.067 |
| Skin color | | | | | |
| White | 286 (19.8) | 50 (17.5) | 1.00 | - | - |
| Brown/black | 1,066 (73.6) | 173 (16.2) | 0.92 | 0.69 – 1.23 | 0.611 |
| Yellow/Indigenous | 96 (6.6) | 10 (10.4) | 0.59 | 0.31 – 1.12 | 0.112 |
| Marital Status | | | | | |
| Married/Stable union | 870 (60.1) | 145 (16.7) | 1.00 | - | - |
| Single/Divorced/ Widow(er) | 578 (39.9) | 88 (15.2) | 0.91 | 0.71 – 1.16 | 0.466 |
| Children | | | | | |
| None | 419 (28.9) | 40 (9.6) | 1.00 | - | - |
| 1-2 | 774 (53.4) | 146 (18.9) | 1.98 | 1.42 – 2.75 | < 0.001 |
| 3 or more | 255 (17.6) | 47 (18.4) | 1.93 | 1.30 – 2.86 | 0.001 |
| Schooling level (years) | | | | | |
| ≥ 8 | 1,184 (81.8) | 183 (15.5) | 1.00 | - | - |
| 5 – 7 | 177 (12.2) | 35 (19.8) | 1.27 | 0.92 – 177 | 0.138 |
| 1 – 4 | 87 (6) | 15 (17.2) | 1.11 | 0.69 – 1.80 | 0.655 |
| Physical activity (times/week) | | | | | |
| Twice or more | 484 (33.4) | 65 (13.4) | 1.00 | - | - |
| Once | 216 (14.9) | 25 (11.6) | 0.86 | 0.55 – 1.32 | 0.501 |
| None | 748 (51.7) | 143 (19.1) | 1.42 | 1.08 – 1.86 | 0.010 |

Continue...

Table 1. Continuation.

| Variables | Population | Obesity | | | |
|---|---|---|---|---|---|
| | n (%) | n (%) | PR | 95%CI | p-value* |
| Smoking | | | | | |
| Non-smoker | 1,007 (69.5) | 150 (14.9) | 1.00 | - | - |
| Former smoker | 212 (14.7) | 44 (20.7) | 1.39 | 1.03 – 1.88 | 0.031 |
| Smoker | 229 (15.8) | 39 (17) | 1.14 | 0.82 – 1.57 | 0.415 |
| Alcohol abuse | | | | | |
| No | 1,257 (86.7) | 197 (15.7) | 1.00 | - | - |
| Yes | 191 (13.3) | 36 (18.8) | 1.20 | 0.87 – 1.65 | 0.260 |
| Medical diagnosis of insomnia | | | | | |
| No | 1,223 (85.1) | 187 (15.2) | 1.00 | - | - |
| Yes | 215 (14.9) | 46 (21.4) | 1.41 | 1.06 – 1.88 | 0.019 |

PR: prevalence ratio; 95%CI: 95% confidence interval; *p-value of Poisson regression.

necessary time for lunch or dinner, and referred having a meal at home three or more times a week (Table 2).

Working for the company for 5.01 to 10 years, being in the same position for 5.01 and 10 years, working the afternoon shift, sometimes alternating working hours and sometimes breaking during the work day were related to obesity in the bivariate level ($p<0.05$) (Table 2).

After multivariate analysis, female gender, aging 30 to 39 years and 40 to 49 years, being in the position for 5.01 to 10 years and 20.01 to 47 years, and physical inactivity remained independently associated with obesity (Table 3).

## DISCUSSION

In the present study, factors associated with obesity were analyzed in a sample of drivers and collectors living in the metropolitan region of Belo Horizonte. To our knowledge, only one study in Brazil[18] and two other international studies[9,10] had similar objectives and target audiences. It is worth mentioning, however, the investigations on prevalence of obesity, whose results, although addressed in the description of the general characteristics of the sample, did not stem from specific problems in the field of study of health-work relation[7,8,11-17,19- 22,25].

In the sample of urban network bus drivers in southern Brazil, age, waist circumference and waist-to-hip ratio were associated with obesity in bivariate analysis, but the authors

Table 2. Association of occupational characteristics with obesity in urban collective transportation workers of the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil, 2012.

| Variables | Population | Obesity | | | |
|---|---|---|---|---|---|
| | n (%) | n (%) | PR | 95%CI | p-value* |
| Position | | | | | |
| Ticket collector | 675 (46.6) | 104 (15.4) | 1.00 | - | - |
| Driver/ Mono-conductor | 773 (53.4) | 129 (16.7) | 1.08 | 0.85 – 1.37 | 0.509 |
| Time in charge (years) | | | | | |
| 0–2 | 541 (37.3) | 69 (12.7) | 1.00 | - | - |
| 2.01–5 | 267 (18.5) | 34 (12.7) | 0.99 | 0.68 – 1.46 | 0.994 |
| 5.01–10 | 220 (15.2) | 46 (20.9) | 1.63 | 1.16 – 2.30 | 0.004 |
| 10.01–20 | 221 (15.3) | 39 (17.6) | 1.38 | 0.96 – 1.98 | 0.077 |
| 20.01–47 | 199 (13.7) | | 1.77 | 1.26 – 2.48 | 0.001 |
| Working hours (shift) | | | | | |
| Morning | 644 (44.5) | 120 (18.6) | 1.00 | - | - |
| Afternoon | 476 (32.9) | 67 (14.1) | 0.75 | 0.57 – 0.99 | 0.045 |
| Nigh | 39 (2.7) | 5 (12.8) | 0.68 | 0.29 – 1.58 | 0.380 |
| Movement | 289 (19.9) | 41 (14.2) | 0.76 | 0.54 – 1.05 | 0.102 |
| Change in working hours | | | | | |
| Never/Rarely | 640 (44.2) | 116 (18.1) | 1.00 | - | - |
| Sometimes | 353 (24.4) | 46 (13) | 0.71 | 0.52 – 0.98 | 0.041 |
| Often/Always | 455(31.4) | 71 (15.6) | 0.86 | 0.65 – 1.12 | 0.277 |
| Other payed work | | | | | |
| No | 1,343 (92.7) | 216 (16.1) | 1.00 | - | - |
| Yes | 105 (7.3) | 17 (16.2) | 1.00 | 0.64 – 1.58 | 0.977 |
| Overtimes or double shifts | | | | | |
| Never/Rarely | 403 (27.8) | 74 (18.4) | 1.00 | - | - |
| Sometimes | 407 (28.1) | 65 (16) | 0.86 | 0.64 – 1.17 | 0.367 |
| Often/Always | 638 (44.1) | 94 (14.7) | 0.80 | 0.60 – 1.05 | 0.121 |
| Works for company during vacation period | | | | | |
| Never/Rarely | 1,285 (88.7) | 207 (16.1) | 1.00 | - | - |

Continue...

Table 2. Continuation.

| Variables | Population | Obesity | | | |
|---|---|---|---|---|---|
| | n (%) | n (%) | PR | 95%CI | p-value* |
| Sometimes | 81 (5.6) | 12 (14.8) | 0.91 | 0.53 – 1.57 | 0.760 |
| Often/Always | 82 (5.7) | 14 (17.1) | 1.05 | 0.64 – 1.73 | 0.817 |
| Feels the body vibrating during work | | | | | |
| Never/Rarely | 574 (39.7) | 89 (15.5) | 1.00 | - | - |
| Sometimes | 309 (21.3) | 49 (15.9) | 1.02 | 0.74 – 1.40 | 0.891 |
| Often/Always | 565 (39) | 95 (16.8) | 1.08 | 0.83 – 1.41 | 0.549 |
| Perception of temperature at work | | | | | |
| Tolerable/A little bothering | 793 (54.8) | 115 (14.5) | 1.00 | - | - |
| Very bothering/ Unbearable | 655 (45.2) | 118 (18) | 1.24 | 0.98 – 1.57 | 0.071 |
| Breaks during shift | | | | | |
| Often/Always | 425 (29.4) | 80 (18.8) | 1.00 | - | - |
| Sometimes | 581 (40.1) | 81 (13.9) | 0.74 | 0.55 – 0.98 | 0.037 |
| Never/Rarely | 442 (30.5) | 72 (16.3) | 0.86 | 0.64 – 1.15 | 0.327 |
| Break for lunch or dinner during shift | | | | | |
| No | 978 (67.5) | 160 (15.5) | 1.00 | - | - |
| Yes | 470 (32.5) | 73 (16.4) | 1.05 | 0.81 – 1.35 | 0.689 |
| Three or more times a week, lunch or dinner | | | | | |
| Home | 922 (63.7) | 138 (15) | 1.00 | - | - |
| Not home | 526 (36.3) | 95 (18.1) | 1.26 | 0.95 – 1.53 | 0.122 |

PR: prevalence ratio; 95%CI: 95% confidence interval; *p-value of Poisson regression.

did not go ahead to multivariate adjustment[18]. In a study conducted in Minneapolis, United States, several factors were associated with obesity, including occupational factors such as being for up to three years in the company, number of hours worked per week, difficult access to fruits and restrictions on physical activity in the workplace[9]. However, one could not infer the independence of relations found, as analyses did not consider multivariate adjustment. In a study developed in Cuneo, Italy, larger numbers of hours on duty per day and lower educational level were independently associated with obesity[10]. However, it was a cross-sectional study with a frequent outcome and the authors[10] used odds ratio (OR) as a measure of association strength, which is methodologically questionable in this scenario[33].

Table 3. Final model post-analysis of Poisson regression. Belo Horizonte, Minas Gerais, Brazil, 2012.

| Variables | PR (95%CI) | p-value* |
|---|---|---|
| Gender | | |
| Male | 1.00 | |
| Female | 1.84 (1.37 – 2.49) | < 0.001 |
| Age (years) | | |
| 18 – 29 | 1.00 | |
| 30 – 39 | 1.66 (1.17 – 2.37) | 0.004 |
| 40 – 49 | 1.59 (1.04 – 2.42) | 0.031 |
| ≥ 50 | 1.00 (0.56 – 1.78) | 0.982 |
| Time in charge (years) | | |
| 0 – 2 | 1.00 | |
| 2.01 – 5 | 0.98 (0.67 – 1.44) | 0.947 |
| 5.01 – 10 | 1.52 (1.06 – 2.18) | 0.023 |
| 10.01 – 20 | 1.20 (0.80 – 1.82) | 0.364 |
| 20.01 – 47 | 1.90 (1.20 – 3.00) | 0.006 |
| Physical activity (times/week) | | |
| Twice or more | 1.00 | |
| Once | 0.96 (0.62 – 1.48) | 0.871 |
| None | 1.32 (1.01 – 1.73) | 0.039 |

PR: prevalence ratio; 95%CI: 95% confidence interval; *p-value of Poisson regression.

Regarding the methodology of the present study, the statistical analyses applied PR instead of OR for the reasons mentioned above. The morbidity was identified in 16.1% of the sample, and demographic (female, older age), behavioral (physical inactivity) and occupational factors (time in office) were independently associated with the outcome after multivariate analysis.

This prevalence differed from evidence found in national and international studies conducted with urban collective transportation workers between 2001 and 2015. Initially, a convergence with frequencies reported in studies conducted in Brazil[16], Poland[15] and Italy[10] is highlighted. However, unequal results have been found, with prevalence in urban collective transportation workers of the metropolitan region of Belo Horizonte being higher than that found in Taiwan[7] and lower than those identified in other countries or regions of Brazil[9,11-14,17-22].

Although the proportion of obesity reported was one of the lowest among investigations carried out with urban collective transportation workers nationally or internationally, the

numbers are worrisome as we conclude that the sample refers to subjects who are formally employed and educated, characteristics that make individuals less vulnerable to chronic diseases in general[21]. However, it is also likely that younger age groups in the sample, when compared to the target populations of other authors[9,11-14,17-22], explain the divergence of results, with advantages for the sample of the present study.

It is well described in the scientific literature that overweight increases with aging[34,35], corroborating the results herein described. The association of weight gain with aging can be explained in part by the decline in basal metabolic rate that physiologically accompanies the aging process. Important to note that this linear tendency of increase in proportion of obesity as age groups increase occurs in both sexes, being a phenomenon observed in cases measured by both BMI and indicators of central obesity[36].

On the other hand, the association of 50 years of age or older with obesity was not maintained. It is possible that survival bias has influenced this unexpected result, since obese individuals are more likely to have temporary sick leave or permanent withdrawal due to retirement or early death[34,35].

The female sex was shown, as expected, to be independently associated with obesity[36-38]. Increased body fat concentration due to previous gestations, hormonal differences and climacterium are some of the disadvantages for women in this respect[39,40].

Moreover, although aspects related to the reproductive period did not constitute questions of the survey, most women in the sample were in this period, and it is plausible to suppose a gestational history with effects on the results described[41].

Also, we highlight the fact that domestic tasks are socially expected to be carried out mainly by women. Thus, the female professional must reconcile her difficult occupational activity with daily housekeeping work, limiting leisure time for recreational activities, such as physical exercise, and increasing weight gain and obesity[42]. Physical inactivity remained independently associated with obesity in our study.

The relationship between sedentary lifestyle and obesity has also been reported by another study with urban collective transportation workers[9]. Physical activity and physical fitness are known to be important modifiers of morbidity and mortality rates related to overweight and obesity[6,43].

However, caution is recommended when interpreting our findings, as we estimated only the frequency of physical activity among participants (none, once a week, two or more times a week), not collecting information about time and intensity. Thus, the reference category of the variable "physical activity twice or more times per week" may include individuals considered physically active (150 or more minutes/week) or insufficiently active (less than 150 minutes/week); the protective effect against obesity has been demonstrated for people in the first category, in general[6].

Greater seniority in this job remained independently associated with obesity, which agrees with the literature[9,10]. This can be explained by the greater exposure, over the years, to ergonomic factors (sitting posture[10]), occupational environment (lack of structure and low social support to maintain healthy habits[9,17]) and working conditions (overtime and absence of breaks during the workday[44]) that increase the risk of obesity.

Sitting posture, when adopted for long periods of the journey, as is the case of the sample studied, is known to decrease the caloric expenditure. In addition, driving hours per day and mileage traveled per year are, in some way, closely related to low availability to perform physical activity and to an unhealthy diet, favoring weight gain[9,10].

It is important to emphasize that, because of the cross-sectional design of the study, it is not plausible to infer causal relations, since one cannot identify a temporality relation between the variables of interest. Furthermore, we must highlight the limitations of cross-sectional studies in occupational health, since there is the possibility of the "healthy worker effect"[19,20]. It is also emphasized that this study did not include a food survey, which limits our findings, as unhealthy eating habits are directly related to obesity[5]. Specifically, only one study carried out with urban collective transportation workers reported an association between the variables "difficult access to fruits at workplace", "use of sweetened beverages, snacks and cold food and drinks", "intake of fat and high-fat milk" and obesity, putting the occupational class of urban collective transportation workers at high risk for overweight[9].

Finally, our findings show the relevance of preventive actions aimed at problems frequently identified in this occupational group, as evidenced by studies that found an association between obesity and sleep disturbance index[45], occurrence of traffic accidents and sleepiness while driving[14], systemic arterial hypertension[15,21,46-48], hyperglycemia[15], increased levels of lead in the blood[49], insomnia and sleep apnea[50,51], and musculoskeletal symptoms[12].

## CONCLUSION

Our findings reinforce the importance of developing promotion actions oriented to a broader, comprehensive perspective of health and related to conditions and organization of work and quality of life, aiming to reduce the proportion of obesity among urban collective transportation workers.

## RESEARCH ETHICS COMMITTEE

CAAE – 02705012.4.0000.5149, Research Ethics and Committee of the Universidade Federal de Minas Gerais.

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# REFERENCES


1. World Health Organization. Obesity and overweight [internet]. Genebra: World Health Organization; 2018 [acessado em 17 nov. 2018]. Disponível em: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
2. Brasil. Vigitel Brasil 2017: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2017. Brasília: Ministério da Saúde; 2018.
3. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012; 380(9859): 2224-60. https://doi.org/10.1016/S0140-6736(12)61766-8
4. Azambuja MIR, Foppa M, Maranhão MFC, Achutti AC. Impacto econômico dos casos de doença cardiovascular grave no Brasil: uma estimativa baseada em dados secundários. Arq Bras Cardiol 2008; 91(3): 163-71. http://dx.doi.org/10.1590/S0066-782X2008001500005
5. Swinburn BA, Caterson I, Seidell JC, James WPT. Diet, nutrition and the prevention of excess weight gain and obesity. Public Health Nutr 2004: 7(1A): 123-46.
6. World Health Organization. Global recommendations on physical activity for health. Genebra: World Health Organization; 2010.
7. Wang PD, Lin RS. Coronary heart disease risk factors in urban bus drivers. Public Health 2001; 115(4): 261-4. https://doi.org/10.1038/sj/ph/1900778
8. Carneiro LRV, Coqueiro RS, Freire MO, Barbosa AR. Signs of musculoskeletal disorders in bus drivers and fare collectors. Braz J Kinanthropom Hum Performance 2007; 9(3): 277-83. https://doi.org/10.5007/%25x
9. French SA, Harnack LJ, Toomey TL, Hannan PJ. Association between body weight, physical activity and food choices among metropolitan transit workers. Int J Behav Nutr Phys Act 2007; 4: 52. https://dx.doi.org/10.1186%2F1479-5868-4-52
10. Rosso GL, Perotto M, Feola M, Bruno G, Caramella M. Investigating Obesity Among Professional Drivers: The High Risk Professional Driver Study. Am J Ind Med 2015; 58(2): 212-9. https://doi.org/10.1002/ajim.22400
11. Saberi HR, Moravveji AR, Fakharian E, Motalebi Kashani M, Dehdashti AR. Prevalence of metabolic syndrome in bus and truck drivers in Kashan, Iran. Diabetol Metab Syndr 2011; 3(8): 1-5. https://dx.doi.org/10.1186%2F1758-5996-3-8
12. Fernández-D'Pool J, Vélez F, Brito A, D'Pool C. Sintomas musculoesqueléticos en conductores de buses de una institución universitaria. Invest Clin 2012; 53(2): 125-37.
13. Thamsuwan O, Blood RP, Chingc RP, Boyle L, Johnson PW. Whole body vibration exposures in bus drivers: A comparison between a high-floor coach and a low-floor city bus. Int J Ind Ergon 2013; 43(1): 9-17. https://dx.doi.org/10.1016/j.ergon.2012.10.003
14. Diez JJ, Vigo DE, Cardinali DP, Pérez-Chada D. Sleep habits, daytime sleepiness and working conditions in short-distance bus drivers. Int J Workplace Health Manag 2014; 7(4): 202-12. https://doi.org/10.1108/IJWHM-02-2013-0004
15. Marcinkiewicz A, Szosland D. Selected risk factors of diabetes mellitus among road transport drivers. Int J Occup Med Environ Health 2010; 23(2): 175-80. https://doi.org/10.2478/v10001-010-0018-3
16. Viegas CAA, Oliveira HW. Prevalência de fatores de risco para a síndrome da apnéia obstrutiva do sono em motoristas de ônibus interestadual. J Bras Pneumol 2006; 32(2): 144-9. http://dx.doi.org/10.1590/S1806-37132006000200010
17. Moraes GN, Fayh APT. Avaliação nutricional e fatores de risco cardiovascular em motoristas de transporte coletivo urbano. Cad Saúde Colet 2011; 19(3): 334-40.
18. Costa MM, Mastroeni SSBS, Reis MAM, Erzinger GS, Mastroeni MF. Excesso de peso em motoristas de ônibus da rede urbana. Rev Bras Cien Mov 2011; 19(1): 42-51.
19. Hirata RP, Carniatto Cerra J, Rodrigues Macedo C, Favareto J, Leitão Filho FSS, Franco de Oliveira LV. Prevalência de obesidade e hipertensão arterial em uma população de motoristas profissionais rodoviários interestaduais de ônibus. Con Scientia e Saúde 2011; 10(3): 494-9. http://dx.doi.org/10.5585/ConsSaude.v10i3.3046
20. Alquimim AF, Barral ABCR, Gomes KC, Rezende MC. Avaliação dos fatores de risco laborais e físicos para doenças cardiovasculares em motoristas de transporte urbano de ônibus em Montes Claros (MG). Ciên Saúde Colet 2012; 17(8): 2151-8. http://dx.doi.org/10.1590/S1413-81232012000800025
21. Benvegnú LA, Fassa AG, Facchini LA, Breitenbach F. Prevalência de hipertensão arterial entre motoristas de ônibus em Santa Maria, Rio Grande do Sul. Rev Bras Saúde Ocup 2008; 33(118): 32-9. http://dx.doi.org/10.1590/S0303-76572008000200004
22. Faria BK, Amorim G, Vancea DMM. Perfil alimentar e antropométrico dos motoristas de ônibus da empresa de Transporte coletivo Jotur/Palhoça – SC. Rev Bras Obes Nutr Emagrec 2007; 1(1): 11-20.

23. Freitas PP, Assunção AÁ, Bassi IB, Lopes ACS. Overweight and workplace in municipal public sector. Rev Nutr 2016; 29(4): 519-27. http://dx.doi.org/10.1590/1678-98652016000400007
24. Battiston M, Cruz RM, Hoffmann MH. Condições de trabalho e saúde de motoristas de transporte coletivo urbano. Estud Psicol 2006; 11(3): 333-43. http://dx.doi.org/10.1590/S1413-294X2006000300011
25. Moura Neto AB, Silva MC. Diagnóstico das condições de trabalho, saúde e indicadores do estilo de vida de trabalhadores do transporte coletivo da cidade de Pelotas - RS. Rev Bras Ativ Fís Saúde 2012; 17(5): 347-58. https://doi.org/10.12820/rbafs.v.17n5p347-358
26. Instituto de Pesquisa Econômica Aplicada. SIPS - Sistema de Indicadores de Percepção Social: mobilidade urbana. Brasília: Instituto de Pesquisa Econômica Aplicada; 2011.
27. Assunção AA. Condições de saúde e trabalho dos motoristas e cobradores do transporte coletivo das cidades de Belo Horizonte, Betim, e Contagem, MG, Brasil [Internet]. Belo Horizonte: Ed. do Autor; 2013 [acessado em 20 abr. 2015]. Disponível em: http://site.medicina.ufmg.br/nest/wp-content/uploads/sites/33/2015/04/Rodoviarios_livro.pdf
28. Empresa de Transportes e Trânsito de Belo Horizonte. Anuário estatístico BHTRANS. Belo Horizonte: Empresa de Transportes e Trânsito de Belo Horizonte; 2009.
29. Conde WL, Oliveira DR, Borges CA, Baraldi LG. Consistência entre medidas antropométricas em inquéritos nacionais. Rev Saúde Pública 2013; 47(1): 69-76. http://dx.doi.org/10.1590/S0034-89102013000100010
30. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Vigitel Brasil 2014: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília: Ministério da Saúde; 2015.
31. World Health Organization. Obesity and overweight: What are overweight and obesity? Genebra: World Health Organization; 2014.
32. Masur J, Monteiro MG. Validation of the "CAGE" alcoholism screening test in a Brazilian psychiatric inpatient hospital setting. Braz J Med Biol Res 1983; 16(3): 215-8.
33. Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol 2003; 3: 21. https://doi.org/10.1186/1471-2288-3-21
34. Gigante DP, Moura EC, Sardinha LMV. Prevalência de excesso de peso e obesidade e fatores associados, Brasil, 2006. Rev Saúde Pública 2009; 43(Supl. 2): 83-9. http://dx.doi.org/10.1590/S0034-89102009000900011
35. Silveira EA, Kac G, Barbosa LS. Prevalência e fatores associados à obesidade em idosos residentes em Pelotas, Rio Grande do Sul, Brasil: classificação da obesidade segundo dois pontos de corte do índice de massa corporal. Cad Saúde Pública 2009; 25(7): 1569-77.
36. Olinto MTA, Nácul LC, Dias-da-Costa JS, Gigante DP, Menezes AMB, Macedo S. Níveis de intervenção para obesidade abdominal: prevalência e fatores associados. Cad Saúde Pública 2006; 22(6): 1207-15. http://dx.doi.org/10.1590/S0102-311X2006000600010
37. Vedana EHB, Peres MA, Neves J, Rocha GC, Longo GZ. Prevalência de obesidade e fatores potencialmente causais em adultos em região Sul do Brasil. Arq Bras Endocrinol Metab 2008; 52(7): 1156-62. http://dx.doi.org/10.1590/S0004-27302008000700012
38. Pinho CPS, Diniz AS, Arruda IKG, Lira PIC, Sequeira LAS, Gonçalves FCLSP, et al. Excesso de peso em adultos do Estado de Pernambuco, Brasil: magnitude e fatores associados. Cad Saúde Pública 2011; 27(12): 2340-50. http://dx.doi.org/10.1590/S0102-311X2011001200006
39. Ronsoni RM, Coutinho MSSA, Pereira MR, Silva RH, Becker IC, Sehnen Júnior L. Prevalência de obesidade e seus fatores associados na população de Tubarão-SC. Arq Catarin Med 2005; 34(3): 51-7.
40. Pinho CPS, Diniz AS, Arruda IKG, Batista Filho M, Coelho PC, Sequeira LAS, et al. Prevalência e fatores associados à obesidade abdominal em indivíduos na faixa etária de 25 a 59 anos do Estado de Pernambuco, Brasil. Cad Saúde Pública 2013; 29(2): 313-24. http://dx.doi.org/10.1590/S0102-311X2013000200018
41. Castanheira M, Olinto MTA, Gigante DP. Associação de variáveis sócio demográficas e comportamentais com a gordura abdominal em adultos: estudo de base populacional no Sul do Brasil. Cad Saúde Pública 2003; 19(Sup. 1): S55-65. http://dx.doi.org/10.1590/S0102-311X2003000700007
42. Landim MB, Victor EG. Escore de Framingham em motoristas de transportes coletivos urbanos de Teresina, Piauí. Arq Bras Cardiol 2006; 87(3): 315-20. http://dx.doi.org/10.1590/S0066-782X2006001600014
43. Allman-Farinell MA, Chey T, Merom D, Bauman AE. Occupational risk of overweight and obesity: an analysis of the Australian Health Survey. J Occup Med Toxicol 2010; 5: 14. https://doi.org/10.1186/1745-6673-5-14
44. Chung Y-S, Wong J-T. Developing effective professional bus driver health programs: An investigation of self-rated health. Accid Anal Prev 2011; 43(6): 2093-103. https://doi.org/10.1016/j.aap.2011.05.032
45. Hui DSC, Ko FW, Chan JK, To KW, Fok JP, Ngai JC, et al. Sleep-disordered breathing and continuous positive airway pressure compliance in a group of commercial bus drivers in Hong Kong. Respirology 2006; 11(6): 723-30. https://doi.org/10.1111/j.1440-1843.2006.00932.x

46. Kaewboonchoo O, Saleekul S, Powwattana A, Kawai T. Blood Lead Level and Cardiovascular Risk Factors among Bus Drivers in Bangkok, Thailand. Ind Health 2007; 45(4): 590-4.
47. Shin S, Lee CG, Song HS, Kim SH, Lee HS, Jung MS, et al. Cardiovascular Disease Risk of Bus Drivers in a City of Korea. Ann Occup Environ Med 2013; 25: 34. https://dx.doi.org/10.1186%2F2052-4374-25-34
48. Lakshman A, Manikath N, Rahim A, Anilakumari VP. Prevalence and Risk Factors of Hypertension among Male Occupational Bus Drivers in North Kerala, South India: A Cross-Sectional. Prev Med 2014; 2014: 1-9. http://dx.doi.org/10.1155/2014/318532
49. Kaewboonchoo O, Morioka I, Saleekul S, Miyai N, Chaikittiporn C, Kawai T. Blood Lead Level and Cardiovascular Risk Factors among Bus Drivers in Bangkok, Thailand. Ind Health 2010; 48(1): 61-5.
50. Razmpa E, Niat KS, Saedi B. Urban Bus Drivers' Sleep Problems and Crash Accidents. Indian J Otolaryngol Head Neck Surg 2011; 63(3): 269-73. https://dx.doi.org/10.1007%2Fs12070-011-0235-5
51. Firat H, Yuceege M, Demir A, Ardic S. Comparison of four established questionnaires to identify highway bus drivers at risk for obstructive sleep apnea in Turkey. Sleep Biol Rhythms 2012; 10(3): 231-6. https://doi.org/10.1111/j.1479-8425.2012.00566.x

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