ABSTRACT | Introduction: This food service sector produces nutritionally balanced meals and its workers eat their meals in this environment. Since they work with nutritionally adequate meals, would these workers have a lower prevalence of obesity? Objectives: The present study aimed to describe the prevalence of obesity among government-backed economy restaurant workers in a Brazilian state capital with analysis of sociodemographic and occupational factors and associated health factors. Methods: Two hundred and fifteen (215) workers from four government-backed economy restaurants operating in the city of Belo Horizonte were evaluated. Only workers who were active during the study period were eligible for the analysis. Anthropometric data were collected for investigation in relation to sociodemographic variables and work and health conditions. Results: The sample of government-backed economy restaurant workers was 37.2% female and had a mean age of 41.9 ± 10.9 years. Based on body mass index, we found that one third of the workers were obese. Obesity was more prevalent among women, workers who were dissatisfied with their bodies, workers who mainly perform tasks in a sitting position, and workers who perform strenuous tasks. Obese people have difficulties performing physical movements, classify their tasks as arduous, and opt for more sedentary tasks. Conclusions: Three out of 10 workers in the government-backed economy restaurants were obese. Programs and actions aimed at prevention and control of obesity are needed in this sector in order to improve the physical and mental capacities of its workers, avoiding attrition of the workforce and major health problems. Keywords | body mass index; obesity; occupational health; restaurants.

RESUMO | Introdução: O setor de alimentação produz refeições nutricionalmente balanceadas, e seus trabalhadores realizam as refeições nesse ambiente. Por trabalharem com refeições nutricionalmente adequadas, será que os trabalhadores apresentam menor prevalência de obesidade? Objetivos: O presente estudo teve como objetivo descrever a prevalência de obesidade entre trabalhadores de restaurantes populares (equipamentos públicos de segurança alimentar e nutricional) em uma capital brasileira e os fatores associados. Métodos: Foram avaliados 215 trabalhadores de quatro restaurantes populares na cidade de Belo Horizonte, sendo elegíveis apenas trabalhadores ativos durante o período do estudo. Foram coletados dados antropométricos para a investigação de variáveis sociodemográficas, condições de trabalho e saúde. Resultados: Da amostra de trabalhadores dos restaurantes populares, 37,2% eram mulheres. A idade média foi de 41,9±10,9 anos. Com base no índice de massa corporal, verificou-se que um terço dos trabalhadores era obeso. A obesidade foi mais prevalente entre mulheres, trabalhadores insatisfeitos com o corpo, trabalhadores que realizam principalmente tarefas na posição sentada e aqueles que realizam tarefas extenuantes. Pessoas obesas têm dificuldades para realizar movimentos físicos, classificam suas tarefas como árduas e optam por trabalhos mais sedentários. Conclusões: Três em cada 10 trabalhadores de restaurantes populares eram obesos. Programas e ações voltados à prevenção e ao controle da obesidade são necessários nesse setor, a fim de melhorar as capacidades físicas e mentais de seus trabalhadores, evitando desgaste da força de trabalho e problemas de saúde significativos. Palavras-chave | índice de massa corporal; obesidade; saúde do trabalhador; restaurantes.
INTRODUCTION

The prevalence of obesity in several countries has gradually increased over almost four decades.¹ Obesity is a chronic non-communicable disease (NCD) caused by changes in dietary pattern, increased calorie intake, and reduced levels of physical activity.² It is an important risk factor for other NCD such as hypertension, heart disease, type 2 diabetes mellitus, and cancer, which are currently the main causes of morbidity and mortality in the world.²

According to the World Health Organization (WHO), 13% of adults aged 18 years or over were obese in 2016.³ In Brazil, data from the Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (Vigitel) telephone survey carried out in 2018 showed that the frequency of obesity in adults was 19.8% in Brazil’s state capitals.⁴

In 2010, nearly 30% of American workers were diagnosed with obesity.⁵ According to the French Social Security Health Examination Center, 8.7% of French workers were obese,⁶ which is similar to the prevalence found in the Dutch working population (10%).⁷ But what is the prevalence of obesity among government-backed economy restaurant (GbER) workers? These restaurants aim to produce nutritionally balanced meals to an appropriate hygienic-sanitary standard that can contribute to maintaining or recovering people’s health. The quality of meals offered in GbER has been observed, identifying healthy and traditional foods typical of the Brazilian food culture.⁸ Workers in these restaurants eat their meals in this environment.

These workers have specific occupational characteristics that could increase their risk of suffering from NCD, especially obesity. This risk is due to frequent contact with food, rigid and standardized routines, and an inappropriate working environment characterized by excessive noise, insufficient lighting, and high temperatures.⁹,¹⁰

Accordingly, the present study aimed to describe the prevalence of obesity among GbER workers in Belo Horizonte and analyze associated sociodemographic, occupational, and health factors. The findings of this study could provide knowledge on these workers’ health and, most importantly, provide guidelines for specific programs and actions aimed at prevention and control of obesity and promotion of healthy living habits among workers in the food service industry.

METHODS

This is a cross-sectional study conducted with GbER workers in the city of Belo Horizonte, the capital of Minas Gerais state, Brazil. The municipality has a population of 2,375,151 inhabitants, and is the sixth largest city in Brazil.⁴

The sample consisted of workers at the four GbER units operating in the municipality in July 2017. The government-backed Economy Restaurants Program (‘Programa Restaurante Popular’ in Brazilian Portuguese) was created in 2003 under the Ministry of Social Development’s Zero Hunger (Fome Zero) social inclusion policy. These units offer balanced meals at affordable prices to the socially vulnerable population.¹¹

The study did not include pregnant women or workers who were on leave (irrespective of reason) or on vacation during the data collection period. The study complies with all ethical standards for research in humans (CAAE-59118916.0.0000.5137).

Data were collected in July 2017 by a team of duly trained researchers. The data collection process was supervised by a head researcher. A semi-structured questionnaire was administered during face-to-face interviews, incorporating scales employed and validated in national¹¹,¹² and international surveys.⁹,¹³,¹⁴

The response variable, obesity, was obtained by measuring the weight and height of the participants, according to WHO standards, and subsequently calculating body mass index (BMI). Workers with BMI ≥ 30 kg/m² were considered obese.¹³ The explanatory variables investigated were: sociodemographic data (gender, age, marital status, educational level, and per capita income), working conditions (physical exertion of job role, working hours, type of employment contract, overtime, environmental conditions, mental exertion, and psychosocial factors), and health conditions (body satisfaction and absenteeism due to emotional problems).
Occupational physical exertion was classified according to the worker’s perception and followed recommendations from Andersen et al.\textsuperscript{15}: a) task performed mainly in a sitting position; b) task performed in a standing position or non-strenuous task in a standing position; c) strenuous tasks. Job roles were also categorized, according to the type of work contract, whether statutory public servant or outsourced worker.

The variable regarding working environment was the workers’ perception about the physical characteristics of the environment in which they perform their functions. This variable includes their assessment of ventilation, temperature, lighting, technical resources, and equipment, and each item was ranked as precarious, reasonable, or satisfactory.\textsuperscript{16}

Mental exertion was defined as the individual’s perception of the intensity with which a task is executed or requested and work-related conflicts.\textsuperscript{10}

Psychosocial occupational characteristics were surveyed using the Job Content Questionnaire (JCQ)\textsuperscript{9,14} demand-control model. This model is composed of the following dimensions: a) demand, which concerns both psychological pressures arising from deadlines assigned to task or procedures and conflicts resulting from contradictory requests in the course of activities; b) control, which addresses the ability to activate intellectual functions and autonomy to operate. These aspects are studied through calculation of mean scores allocated to quadrants that express the relationships between them (passive work, low demand, active work, and high demand). Harmful situations are classified into two types: (i) high psychological demand under high control = active work or (ii) low demand under low control = passive work.

Absenteeism due to emotional problems entailed absences motivated by depression, stress, or anxiety in the 12 months prior to the interview. Satisfaction with body weight was also registered.

A bivariate analysis was carried out using Poisson regression models with robust variance. Obesity was the dependent variable and the explanatory variables were sociodemographic characteristics and work and health conditions. Predictive variables with p values lower than 20% (p < 0.20) were included in the multivariate Poisson regression model with robust variance by the backward method and less significant variables (greater p-value) were withdrawn one by one from the model. The procedure was repeated until all the variables present in the model were statistically significant (p < 0.05). The fit of the final model was verified with the Hosmer and Lemeshow test. A prevalence ratio (PR) with a 95% confidence interval (95% CI) was used as a measure of effectiveness. The data obtained were analyzed using Stata software, version 14.0. A significance level of 5% was adopted for all analyses.

RESULTS

Only 215 individuals of the total of 258 GbER workers were analyzed, because 29 were ineligible (10.1%), 11 refused to participate in the study (3.8%), and 3 did not complete the interview (1%). Most of the participants were female, with an average age of 41.9 ± 10.9 years and 33% were obese. Further information regarding the description of the sample is presented in Table 1.

The bivariate analysis (Table 1) showed that the prevalence of obesity was higher among women (41.5 vs. 18.8%, p = 0.001), workers with elementary education (51.2 vs. 29% of those with high school education and 27.6% of those with college education, p = 0.022), workers who performed tasks mainly in a sitting position (35.3 and 38.3%, respectively, vs. 11.6% of those who perform tasks in a standing position or non-strenuous task in a standing position, p = 0.004), and those dissatisfied with their body weight (50% vs. 7.1%, p < 0.001).

The multivariate analysis showed that factors such as gender, occupational physical exertion, and satisfaction with body weight were independently associated with obesity (Table 2). The prevalence rates of obesity were higher among women than men (PR: 1.68, 95%CI 1.04-2.69) and were higher among workers who performed tasks mainly in a sitting position or perform strenuous tasks (35.3 and 38.3%, respectively, vs. 11.6% of those who perform tasks in a standing position or non-strenuous task in a standing position, p = 0.004), and those dissatisfied with their body weight (50% vs. 7.1%, p < 0.001).

The multivariate analysis showed that factors such as gender, occupational physical exertion, and satisfaction with body weight were independently associated with obesity. The prevalence rate of obesity was higher among women than among men (PR: 1.68, 95%CI 1.04-2.69) and were higher among workers who performed tasks mainly in a sitting position (PR: 2.89, 95%CI 1.12-7.43 (PR: 3.26, 95%CI 1.46-7.31) than among individuals whose jobs required them to stand or those who performed non-strenuous task in a standing position. Individuals dissatisfied with their body image had higher prevalence of obesity than those who were not (PR: 6.39, 95%CI 2.90-14.00) (Table 2).
**Table 1. Distribution of the prevalence of obesity according to sociodemographic characteristics, working conditions, and health, Belo Horizonte, 2017**

| Variables                                | Total (%) | Obesity (%) | p-value* |
|------------------------------------------|-----------|-------------|----------|
|                                          |           | No          | Yes      |          |
| Sociodemographic                         |           |             |          |          |
| Sex                                      |           |             |          |          |
| Female                                   | 62.8      | 58.5        | 41.5     | 0.001    |
| Male                                     | 37.2      | 81.3        | 18.8     |          |
| Age (years)                              |           |             |          |          |
| ≤ 30                                     | 19.1      | 80.5        | 19.5     |          |
| 31 to 40                                 | 26.0      | 71.4        | 28.6     | 0.095    |
| 41 to 50                                 | 31.6      | 60.3        | 39.7     |          |
| > 50                                     | 23.3      | 60.0        | 40.0     |          |
| Marital status                           |           |             |          |          |
| With partner                             | 46.7      | 65.0        | 35.0     | 0.596    |
| Without partner                          | 53.3      | 68.4        | 31.6     |          |
| Educational level                        |           |             |          |          |
| Elementary school                        | 19.1      | 48.8        | 51.2     |          |
| High school                              | 67.4      | 71.0        | 29.0     | 0.022    |
| College education                        | 13.5      | 72.4        | 27.6     |          |
| Income per capita (quartile)             |           |             |          |          |
| ≤ 468.85                                 | 25.2      | 58.5        | 41.5     |          |
| 468.86-750.00                            | 26.7      | 69.6        | 30.4     | 0.433    |
| 750.01-1250.00                           | 24.8      | 71.2        | 28.8     |          |
| ≥ 1250.01                                | 23.3      | 71.4        | 28.6     |          |
| Working conditions                       |           |             |          |          |
| Physical demand of the position          |           |             |          |          |
| Mainly in a sitting position             | 79        | 64.7        | 35.3     |          |
| Task performed in a standing position or non-strenuous task | 201 | 88.4 | 11.6 | 0.004 |
| Strenuous tasks                          | 72.0      | 61.7        | 38.3     |          |
| Psychological demand                     |           |             |          |          |
| Low                                      | 52.6      | 62.8        | 37.2     | 0.174    |
| High                                     | 47.4      | 71.6        | 28.4     |          |
| Work duration                            |           |             |          |          |
| Up to one year and a half                | 31.2      | 64.2        | 35.8     | 0.557    |
| More than one year and a half            | 68.8      | 68.2        | 31.8     |          |
| Type of employment contract              |           |             |          |          |
| Statutory public servant                 | 51        | 90.9        | 9.1      | 0.086    |
| Outsourced worker                        | 949       | 660         | 340      |          |
| Overtime                                 |           |             |          |          |
| No                                       | 930       | 66.7        | 33.3     | 0.287    |
| Yes                                      | 70        | 80.0        | 20.0     |          |
| Environmental conditions                  |           |             |          |          |
| Satisfactory                             | 373       | 68.8        | 31.3     | 0.387    |
| Reasonable                               | 150       | 56.3        | 43.7     |          |
| Precarious                               | 477       | 68.6        | 31.4     |          |

Continued on next page
DISCUSSION

Three out of ten GbER workers in Belo Horizonte were obese. The occurrence of obesity was higher among women, workers who reported body dissatisfaction, and those who perform mainly sedentary tasks and strenuous activities.

The prevalence in this group was higher than the prevalence in Brazilian adults. When compared with other categories of public workers, the prevalence was lower than in different positions within the entire municipal sector (44.4%, Belo Horizonte) and within a hospital service (63.9%, Porto Alegre), respectively. However, these results are still cause for concern.

Table 1. Continued

| Variables                                      | Total (%) | Obesity (%) | p-value* |
|-----------------------------------------------|-----------|-------------|----------|
| Demand-control model                          |           |             |          |
| Low demand                                    | 177       | 579         | 421      | 0.404    |
| Active work                                   | 209       | 756         | 244      |          |
| Passive work                                  | 349       | 667         | 333      |          |
| High demand                                   | 265       | 667         | 333      |          |
| Health conditions                             |           |             |          |
| Absenteeism due to emotional problems         |           |             |          |
| No                                            | 940       | 627         | 373      | 0.643    |
| Yes                                           | 60        | 714         | 286      |          |
| Body satisfaction                             |           |             |          |
| No                                            | 601       | 500         | 500      | < 0.001  |
| Yes                                           | 399       | 929         | 71       |          |

* Chi-square or Fisher’s exact test.

Table 2. Final Poisson Regression model for factors associated with obesity, Belo Horizonte, 2017

| Variables                                      | PR       | 95% CI     | p-value |
|-----------------------------------------------|----------|------------|---------|
| Sociodemographic                              |          |            |         |
| Sex                                           |          |            |         |
| Female                                        | 168      | 104-269    | 0.031   |
| Male                                          | (ref)    | -          | -       |
| Working conditions                             |          |            |         |
| Physical demand of the position               |          |            |         |
| Mainly sedentary jobs                         | 289      | 112-743    | 0.028   |
| Task performed in a standing position or non-strenuous task | (ref) | - | - |
| Strenuous tasks                               | 3.26     | 146-731    | 0.004   |
| Health conditions                             |          |            |         |
| Absenteeism due to emotional problems         |          |            |         |
| No                                            | 6.39     | 2.90-14.00 | < 0.001 |
| Yes                                           | (ref)    | -          | -       |

Goodness-of-fit = 69.0531; p-value = 1.00
95%CI = 95% confidence interval; PR = prevalence ratio.
since the implications of obesity result in reduced productivity and working capacity and increased absenteeism, turnover, and social costs.\textsuperscript{19}

In addition, these workers perform activities in a sector in which the primary function is preparation of nutritionally balanced meals. The food service industry needs to understand the obesity scenario among its workers and its associated factors so it can intervene. It should be noted that addressing obesity in the workplace is directly related to knowledge of the economic burden of obesity.\textsuperscript{20}

Promoting education and health at work and changes in the workplace can reduce the prevalence of obesity.\textsuperscript{20} It is suggested that employers provide facilities or materials for practicing physical activities; reduce the availability of food at the workplace; provide nutritional information and develop skills related to adoption of healthy eating habits; and conduct actions to promote food and nutrition education.

We also observed lower quality of life, associated with discrimination and possibly lower levels of education and income. Obese workers reported higher discrimination at the workplace compared to non-obese workers. In fact, discrimination begins when they apply for the position.\textsuperscript{21}

Manifestations of discrimination endorse a greater perception of body dissatisfaction among obese workers, allied with the cultural perspective of beauty.\textsuperscript{2,22} According to Western culture, women should be thin and slender, while men must be lean and muscular.\textsuperscript{23} This lean body cult is propagated by the media throughout the world and is extremely important in the Brazilian culture.\textsuperscript{24} Changes in the working conditions of many professional categories have contributed to development of lifestyle-related diseases, including obesity. Studies show that obesity influences people's ability to meet the demands of work (work schedule and physical and mental demands) because it can impair physical, psychosocial, and cognitive functioning.\textsuperscript{25}

Work limitations caused by obesity are mainly related to time and physical demands.\textsuperscript{7,17,26} Working in the food service industry requires workers to adapt to the work environment and engage in various physical movements, including bending, squatting, and carrying and moving heavy loads. Obese people often experience difficulties performing these movements due to their body size and weight, causing them to opt for more sedentary jobs.\textsuperscript{26}

However, the results showed a higher prevalence of obesity among workers who classified their jobs as strenuous. One possible explanation for this is that obese workers have a different perception of effort, thus influencing their classification of their own tasks, since BMI negatively affects muscle fatigue and resistance.\textsuperscript{27}

It should be noted that occupational demands that do not match the physical and mental capabilities of workers could cause health problems and workforce attrition. Obesity is known to be associated with development of musculoskeletal disorders, osteoarthritis, and chronic diseases.\textsuperscript{2,28} Therefore, efforts associated with the practice of physical activity during leisure time are apparently beneficial for improvement of musculoskeletal capacity and reduction of body weight.\textsuperscript{25,29} Work-related interventions should focus on increasing autonomy at work, while important topics such as professional skills and work attitude should be addressed in such interventions.\textsuperscript{25} Given that the work environment is a space conducive to health education activities, approaches aimed at specific occupational groups are desirable in order to stimulate healthier living habits, which consequently contribute to disease control and prevention.

The results of the study are limited by the non-participation of workers who were on leave for more than 30 days. This is a possible source of bias, since sick or complaining workers are not included in the study population.\textsuperscript{30,31}

**CONCLUSIONS**

Three out of 10 of the food service industry workers studied were obese. The factors associated with the prevalence of obesity were gender, body dissatisfaction, and occupational physical exertion. Therefore, programs and actions focused on prevention and control of obesity are necessary in the food service industry in order to increase the physical and mental capabilities of workers, avoiding workforce attrition and major health problems.
Obesity among workers

Author contributions

BVLC and SAR were responsible for the study conceptualization, project administration, supervision, data curation, and writing - original draft and review & editing. PMH, MZI, and ASC participated in the formal analysis and writing - original draft and review & editing. All authors have read and approved the final version submitted and take public responsibility for all aspects of the work.

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