Inactive commuting to work and associated factors in industrial workers[1]

Inatividade nos deslocamentos para o trabalho e fatores associados em industriários

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Resumo

O objetivo deste estudo foi analisar a prevalência e identificar fatores associados à inatividade física nos deslocamentos para o trabalho em trabalhadores da indústria do Estado de Pernambuco, Brasil. Dados para realização desse estudo transversal foram coletados numa amostra com 1.910 trabalhadores mediante utilização de questionário previamente validado. Informações sobre a prática de atividades físicas nos deslocamentos foram obtidas pelo tempo despendido e pelo modo como os sujeitos relataram que se deslocavam para ir ao trabalho, na maioria dos dias da semana. Análise dos dados foi realizada por regressão logística binária com modelagem hierárquica. Verificou-se que 84,2% dos trabalhadores são fisicamente inativos nos deslocamentos para o trabalho. Após ajustamento para fatores demográficos, socioeconômicos e outros fatores relacionados à saúde, observou-se tanto em homens quanto em mulheres que a renda familiar e o porte da empresa estavam diretamente associados à inatividade nos deslocamentos para o trabalho. Nos homens, a inatividade nos deslocamentos estava também diretamente associada à escolaridade e à diabetes autorreferida. Concluiu-se que a prevalência de deslocamento inativo é alta e está associada a fatores individuais, sociais e organizacionais.

Palavras-chave: Atividade motora; Deslocamento residência-trabalho; Caminhada; Ciclismo; Trabalhadores; Brasil.

Abstract

This study analyzed the prevalence and identified the factors associated with inactive commuting to work among industrial workers from Pernambuco, Brazil. Data for this cross-sectional study were gathered from a sample of 1,910 industrial employees by using a previously validated questionnaire. The measure of inactive commuting to work was based on self-reported time and mode of transportation to work on most days of a typical week. Data analysis was carried out through binary logistic regression using a hierarchical approach. It was observed that 84.2% of workers were inactive commuters. After adjustment for demographic, socio-economic, and other health-related factors in both men and women, it was found that family income and company size were directly associated with inactive commuting to work. Moreover, among men, inactive commuting was directly associated with schooling level and was associated with a self-reported diabetes. It was concluded that the prevalence of inactive commuting to work was high and directly associated with individual, social, and organizational factors.

Keywords: Motor Activity; Commuting; Walking; Cycling; Workers; Brazil.

Introduction

The active modes of transportation such as walking or bicycling can provide an important opportunity to practice daily physical activities (Tudor-Locke et al., 2001) and contribute to reducing the prevalence of physical inactivity observed in our population (Brasil, 2010). Commuting physical activity is also important because international studies showed that individuals in physically active commuting have a lower risk of morbidity and mortality from chronic diseases (Gordon-Larsen et al., 2009; Hamer and Chida, 2008; Andersen et al., 2000).

There is evidence that active commuting is a health behavior that is directly associated with improving physical fitness in both men and women, as well as being inversely associated with body mass index (BMI), obesity, triglycerides, and blood pressure in men (Gordon-Larsen et al., 2009). A meta-analysis conducted by Hamer and Chida (2008) showed that active commuting is associated with a 11% reduction in total cardiovascular risk, noting that active modes of transportation confers a strong protective effect in women. Furthermore, a study by Andersen and collaborators (2000), demonstrated that bicycling on the path from home to work reduces the risk of mortality from all causes.

Although evidence demonstrating that the commuting physical activity is associated with various health benefits, the prevalence of youth and adults who walk or cycle to work is low. Available studies show that approximately 72% of Americans do not walk as a form of commuting (Kruger et al., 2008) and 37.4% of Europeans carry little or no type of active mode of transportation (Abu-Omar and Rütten, 2008).

In Brazil, few epidemiological studies have been conducted to identify the proportion of physically inactive commuting individuals, but the available evidence suggests that in the general adult population, the prevalence of physical inactivity in this domain is high (Santos et al., 2009; Peixoto et al., 2008). The result was similar to that observed in the worker population living in the urban area of Pelotas, where only 17.2% of the participants use the bicycle as a means of commuting to work (Bacchieri et al., 2005).

The available evidence and the considerable knowledge gaps in this field suggest that physical activity in the context of commuting has been ignored, despite representing a major alternative to the actions aimed at promoting physical activity at the population level (Mutrie et al., 2002; Tudor-Locke et al., 2001). Based on the above considerations, this study analyzed the prevalence and factors associated with physical inactivity in commuting to work in a representative sample of industrial workers in the State of Pernambuco, Brazil.

Methods

A cross-sectional design, based on a secondary analysis of data from an epidemiological survey entitled "Lifestyle and leisure habits of workers of Brazilian industries", was used in the development of this study. The study protocol was approved by the Ethics Committee on Human Research of the Federal University of Santa Catarina (Protocol #009/2007). All the guidelines set forth in resolutions 196 and 251 of the National Health Council were observed in the development of this study.

The target population was approximately 132,000 workers in the industry according to data provided by the Anual Report of Social Information, RAIS (*Relação Anual de Informações Sociais*) of the regional department of the Industrial Social Services in Pernambuco (*Serviço Social da Indústria*). We excluded companies with fewer than 20 workers, qualified as micro-enterprise, due to the volatility of the labor force and informal labor relations with its workers.

To select the sample, it was used a two-stage cluster sampling process, in which industries and the workers, respectively, represented the sampling unit in the first and second stages. The sample selection allowed including industries and workers in the operation area of all service units of the regional department of the Industrial Social Services in Pernambuco, thus covering the main industrial centers of the state.

In the first stage, it was used a random selection of companies, considering their distribution in relation to size (number of workers): large (500 or more workers), medium (100-499 workers), and small (20-99 workers) companies. Approximately 10% of the total companies were randomly selected in proportion to the size located in every region of the state, settling the number of companies to be visited to 101 (11 large-, 22 medium-, and 68 small--sized companies). Then, by calculating the ratio between the quantity of workers to be selected and industries already drawn in each attendance unit, we determined the number of participants per company.

In the second stage, knowing the companies drawn and the number of workers to be selected, the researchers resorted to alphabetically ordered lists with the names of the workers of each company, to conduct the systematic selection of the participants. After this stage, formal contact with the management of the companies was made to obtain consent to fill questionnaires and setting the dates, locations, and times to perform of collection. Other companies of similar size, preferably from the same industrial manufacturing area, replaced companies that refused to participate. The same procedure was adopted for workers drawn who refused or were absent on the day of completion of data collection in the company.

In the calculation of the sample size, the following criteria were adopted: population estimated 132,647,000 individuals, confidence interval of 95%, statistical power of 80%, sampling error of three percentage points; prevalence estimated at 50%, and the sampling design effect set at 1.5. The initial estimate of the sample size was increased by 20% to offset the need for analysis adjustment of possible confounding factors. The required sample size was set at 1,910 individuals, representing about 1.4% of the total industrial workers in Pernambuco.

Referring to statistical power calculations it was found that this sample dimensioning would enable analysis of the association between variables with the possibility to detect statistically significant odds ratio (OR) of 1.4 or more, considering: outcome prevalence between 20% and 81% in the exposed and between 25% and 75% in the unexposed; prevalence of the outcome in the group of non-exposed male of 57.4%; prevalence of the outcome in the group of non-exposed female of 33.8%; statistical power of 80%; and a confidence level of 95%.

Data collection was conducted during the spring

semester of 2006. The information was self-reported and obtained through a questionnaire previously tested (Barros, 1999; Fonseca, 2005) and has been used in several studies of workers in the industrial sector (Del Duca et al., 2012; Silva et al., 2012; Del Duca et al., 2011; Silva et al., 2011; Fonseca et al., 2008). The face validity and content was verified by consulting experts (researchers with experience in conducting epidemiological research focused on health workers). The consistency of measurements (test-retest reproducibility) was tested in a group of servers of the Federation of Industries of the State of Santa Catarina (FIESC) and in the Industrial Social Services (SESI), adopting a one week interval between applications. Consistency measures of test-retest reliability were moderate to strong in most of the issues in the questionnaire. The coefficients of agreement (Kappa, k) showed an acceptable reproducibility for measurements of demographic and socioeconomic characteristics (k = 0.90), as well as factors related to lifestyle (k = 0. 40). The kappa coefficient to measure the outcome variable in this study was 0.55. There were no statistically significant differences between measured and self-reported measures of weight and height (Barros, 1999).

The application of the instrument was conducted by previously trained interviewers, and the respondents at the time of application could request clarifications and help from interviewers. In the event that a worker could not independently complete their questionnaire was aided by the interviewer that led to an individual interview. The questionnaire lasted about 30 minutes with a small group of workers (8–15 participants per application).

Information concerning physical activity in commuting was obtained by two questions: "How do you commute to go to work most days of the week?" and "considering the paths back and forth to work on most days of the week, how much time do you spend walking or bicycling?" Workers who reported that they did not walk or cycle to work were classified as "inactive" as well as those who, regardless of the mode of travel, said they would spend 10 minutes or less time per day in commuting.

The demographic and socioeconomic variables included in the study were gender (male, female), age (≤ 39 years, ≥ 40 years), marital status (married, not married); gross family income (up to 1,500 Brazilian reais, 1,500 Brazilian reais or above), education (incomplete high school education, completed high school or higher education); company size (small, medium, and large). Health perception was determined by a single question ("How do you rate your current health status?"), and the participants who reported health as "excellent" or "good" were classified in a positive category, and those who reported health as "fair" or "poor" were classified in a negative category. Similarly, the measure of perceived stress was obtained by a single question ("How do you rate the level of stress in your life?") and dichotomized into two groups (positive and negative), and those who reported that they feel "almost always stressed" or "always stressed," struggling to cope with daily life were classified as having a negative perception."

In addition, we determined the presence of excess body weight by classification of BMI that has been derived from self-reported measures of weight and height. The physical activity during leisure time (active, inactive) was determined by the participants responses to a single question ("do you regularly perform some sort of physical activity during your leisure time, such as physical exercise, sports, dance or martial arts?"), was considered as being active who reported participation in activities on five or more days in a typical week (normal). Self-reported measures of the presence of the following conditions: high blood pressure and high cholesterol as well as diabetes were also considered.

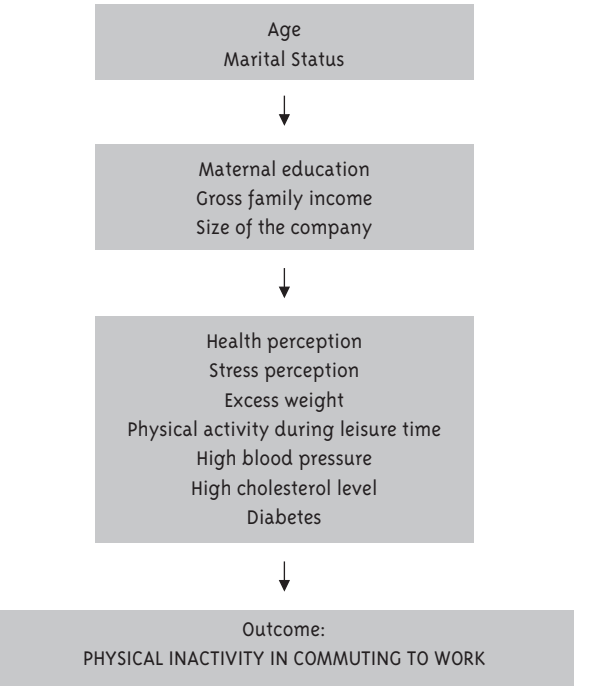
The construction of the database of industrial workers was performed by the optical reading of the questionnaires through the SPHYNX software *(Sphynx Software Solutions Incorporation,* Washington, United States). To detect possible errors and outliers, the data for each variable was manually and electronically checked and corrected.

To perform the analysis, we used the STATA statistical package (version 10), using procedures of descriptive statistics (frequency distribution) and inference. In bivariate analysis, we used the application of Chi-square and Chi-square test for trend. This procedure was used to present the reader with a comparison of the prevalence of commuting physical inactivity between the categories of independent variables.

In multivariate analysis, we used binary logistic regression, adopting physical inactivity in commuting to work as an outcome. A hierarchical model was used to establish the order of entry of the independent variables, as suggested in the literature (Dumith, 2008). The conceptual model of analysis that was adopted considered three levels of causal determination (proximal, intermediate, and distal). On the first level, demographic factors were included (age, marital status), on the second level, socioeconomic factors were added (gross family income, education, size of the company), and on the last level, factors related to health were inserted (health perception, perceived stress, excess weight, physical activity during leisure time, and self-reported data on high blood pressure, high cholesterol, and diabetes) (Figure 1).

In the regression analysis, the variables were analyzed for each block hierarchically adjusted for those who were in the next higher level, and only those variables that had a p value lower than 0.2 for the likelihood ratio test were kepted in the model. In the final regression model, were considered factors significantly associated with physical inactivity in commuting only those for which the p value was lower than 0.05.

Figure 1 - Hierarchical model analysis of factors associated with physical inactivity in commuting



Results

Were visited 101 companies (~10% of total state industries) located in 12 regional units of the Industrial Social Services in Pernambuco, as previously established in the sample design. There was no refusal of companies, and in the second stage of the sampling procedure there was no loss because the procedure was conducted with replacement of refusals and absences, as described in "Methods." The quantity of refusals and absences from work on the day of data collection was not recorded by the researchers.

The sample consisted of 1,910 workers in the industrial sector, with a higher proportion of men (78.5%). About 70% of industrial workers were less than 39 years old and 64.2% lived in communion with a stable partner. Table 1 shows the characteristics of the sample according to demographic, socioeconomic, and health-related factors, stratified by gender.

The prevalence of physical inactivity in commuting was 84.2% (95% CI: 82.0-85.4). There was no statistically significant difference (p = 0.55) between the proportion of women (85.2%) and men (83.9%) physically inactive in the domain of commuting.

In the bivariate analysis, the variables associated with the prevalence of physical inactivity in commuting to work were as follows: family income, education, company size, and high cholesterol level. There was a higher proportion of physically inactive individuals in commuting among workers who reported having a household income above 1,500 Brazilian reais and higher level of education, compared, respectively, with those who reported having an income of less than or equal to 1,500 reais and less formal education. Additionally, there was a tendency to increase the prevalence of physical inactivity in commuting with the increasing size of the company. Commuting physical inactivity was statistically higher ($p < 0.01$) among the industrial workers who reported working in large companies (87.2%) when compared with those working in medium- (83.9%) and small-sized companies (76.6%). Furthermore, the prevalence of physical inactivity in commuting

Table 1 - Number and proportion (%) of workers in the industrial sector (n = 1,910) according to demographic, socioeconomic, and health factors, State of Pernambuco, Brazil, 2006

Variable	Categories	Men		Women	
		%	n	%	n
Age (years)	≤ 39	68.7	1,030	72.3	297
	≥ 40	31.3	469	27.7	114
Marital Status	Married	71.0	1,064	39.4	162
	Other	29.0	435	60.6	249
Gross family Income	≤ R$ 1,500	90.1	1,351	77.1	317
	> R$ 1,500	9.9	148	22.9	94
Scholarity	Incomplete high school education	48.6	729	25.1	103
	Complete high School Education or higher	51.4	770	74.9	308
Company Size	Small	17.4	261	31.1	128
	Medium	26.2	393	25.6	105
	Large	56.4	845	43.3	178
Perception of health	Positive	79.1	1,186	77.1	317
	Negative	20.9	313	22.9	94
Perception of stress	Positive	88.9	1,333	79.1	325
	Negative	11.1	166	20.9	86
Excess weight	No	52.7	790	70.2	288
	Yes	47.3	708	29.8	122
Leisure-time physical activity	Active	87.0	1,304	85.9	353
	Inactive	13.0	195	14.1	58
High blood Pressure	No	85.5	1,218	84.0	330
	Yes	14.5	206	16.0	63
High cholesterol level	No	91.2	1,032	86.4	304
	Yes	8.8	100	13.6	48
Diabetes	No	97.5	1,115	97.5	357
	Yes	2.5	28	2.5	9

was higher (p = 0.03) among workers who reported high cholesterol (92.6%) compared with those who did not (86.1%).

The prevalence of physical inactivity in commuting according to demographic, socioeconomic, and health-related is presented in Table 2. We used the stratification of analysis by gender, seeking to characterize population subgroups at higher risk and to verify differences between men and women regarding factors associated with the study outcome.

Multivariate regression analysis showed that, both among men and women, physical inactivity while commuting was directly associated with family income and the size of the company (Tables 3 and 4). Moreover, among male workers, it was found that physical inactivity in commuting was directly associated with the level of formal education and the presence of self-reported diabetes. Industrial workers who reported having diabetes have lower odds of physical inactivity in commuting compared with those who did not (Table 3).

Discussion

The study shows that the prevalence of physical inactivity in commuting among industrial workers in Pernambuco was high compared with that reported in national and international studies. In both genders, it was found that family income and size of the company are directly associated with this outcome. Moreover, among male workers, the prevalence of physical inactivity in commuting was higher among participants with higher income and, interestingly, lower among workers who reported being diabetic.

Table 2 - Number and proportion (%) of workers in physically inactive commuting according to demographic, socioeconomic, and health factors, stratified by sex. Pernambuco, Brazil, 2006

Variables	Categories	Physical Inactivity in commuting to work			
		Men		Women	
		%	n	%	n
Age (years)	≤ 39	83.2	853	86.9	258
	≥ 40	85.6	397	80.7	92
	p Value *	0.25		0.11	
Marital Status	Married	83.5	881	84.6	137
	Other	85.0	369	85.5	213
	p Value *	0.47		0.79	
Gross family Income	≤ R$ 1,500	82.9	1,112	82.3	261
	> R$ 1,500	93.9	138	94.7	89
	p Value *	< 0.01		< 0.01	
Scholarity	Incomplete high school education	81.0	586	69.9	72
	Complete high School Education or higher	86.7	664	90.3	278
	p Value *	< 0.01		< 0.01	
Company Size	Small	76.2	199	77.3	99
	Medium	83.4	322	85.7	90
	Large	86.6	729	90.4	161
	p Value **	< 0.01		0.01	
Perception of health	Positive	84.3	992	85.8	266
	Negative	82.4	258	83.2	84
	p Value *	0.41		0.52	
Perception of stress	Positive	84.4	1,117	84.9	276
	Negative	80.1	133	86.0	74
	p Value *	0.15		0.79	
Excess weight	No	82.3	647	84.7	244
	Yes	85.7	602	86.1	105
	p Value *	0.07		0.73	
Leisure-time physical activity	Active	83.7	1,083	85.0	300
	Inactive	85.6	167	86.2	50
	p Value *	0.49		0.81	
High blood Pressure	No	83.7	1,014	85.1	281
	Yes	87.7	178	85.7	54
	p Value *	0.15		0.91	
High cholesterol level	No	85.9	881	86.5	263
	Yes	93.0	93	91.7	44
	p Value *	0.05		0.32	
Diabetes	No	86.5	958	86.8	310
	Yes	75.0	21	77.8	7
	p Value *	0.08		0.43	

* Chi-square Test for heterogeneity; ** Chi-square Test for trend

Table 3 - Logistic regression analysis to identify factors associated with physical inactivity in commuting to work, in male workers (n = 1,499). Pernambuco, Brazil, 2006

Variable	Crude OR (95%CI)	p Value	Adjusted OR* (95% CI)	p Value
Age (years)				
≤ 39	1			
≥ 40	1.19 (0.88-1.62)	0.26	Deleted	
Marital Status				
Married	1			
Other	1.12 (0.82-1.53)	0.47	Deleted	
Family Income				
≤ R$ 1,500	1		1	
> R$ 1,500	3.17 (1.59-6.32)	< 0.01	2.92 (1.45-5.89)	<0.01
Scholarity				
Incomplete high school education	1		1	
Complete high School Education or higher	1.52 (1.15-2.01)	<0.01	1.35 (1.01-1.79)	0.04
Company Size				
Small	1		1	
Medium	1.57 (1.06-2.32)	0.02	1.60 (1.08-2.37)	0.02
Large	2.01 (1.42-2.84)	<0.01	2.04 (1.44-2.90)	<0.01
Perception of health				
Positive	1			
Negative	0.87 (0.62-1.21)	0.41	Deleted	
Perception of stress				
Positive	1		1	
Negative	0.74 (0.49-1.12)	0.16	0.68 (0.39-1.19)	0.18
Excess weight				
No	1		1	
Yes	1.29 (0.98-1.71)	0.07	1.01 (0.70-1.47)	0.95
Leisure-time physical activity				
Active	1			
Inactive	1.16 (0.76-1.78)	0.49	Deleted	
High blood Pressure				
No	1		1	
Yes	1.39 (0.89-2.17)	0.15	0.95 (0.56-1.62)	0.86
High cholesterol level				
No	1		1	
Yes	2.17 (0.99-4.78)	0.05	2.39 (0.99-5.79)	0.05
Diabetes				
No	1		1	
Yes	0.47 (0.19-1.12)	0.09	0.25 (0.09-0.67)	0.01

* Multivariate Analysis by binary logistic regression following a hierarchical model in three levels.

In addition to the intrinsic limitations of cross-sectional studies, this survey may have been affected by measurement bias. Information concerning some variables were based on self-report that may lead to overestimation or underestimation of the measurements. The low prevalence of hypertension, high cholesterol, and diabetes was observed in this study may be due to the "healthy worker bias," generated by replacement workers and companies during the sampling process. As all data were simultaneously collected, the observed associations are also subject to the possibility of reverse causality bias.

Table 4 - Logistic regression analysis to identify factors associated with physical inactivity in commuting to work in male workers (n = 411). Pernambuco, Brazil, 2006

Variable	Crude OR (95 %CI)	p Value	Adjusted OR* (95% CI)	p Value
Age (years)				
≤ 39	1		1	
≥ 40	0.63 (0.36-1.12)	0.12	0.63 (0.36-1.13)	0.12
Marital Status				
Married	1			
Other	1.08 (0.62-1.88)	0.79	Deleted	
Gross family Income				
≤ R$ 1,500	1		1	
> R$ 1,500	3.82 (1.48-9.83)	0.01	3.39 (1.80-6.39)	< 0.01
Scholarity				
Incomplete high school education	1		1	
Complete high School Education or higher	3.99 (2.27-7.02)	< 0.01	2.38 (0.88-6.44)	0.09
Company Size				
Small	1		1	
Medium	1.76 (0.88-3.49)	0.11	1.74 (0.84-3.58)	0.13
Large	2.77 (1.45-5.31)	< 0.01	3.09 (1.56-6.09)	< 0.01
Perception of health				
Positive	1			
Negative	0.82 (0.44-1.51)	0.52	Deleted	
Perception of stress				
Positive	1			
Negative	1.09 (0.55-2.16)	0.79	Deleted	
Excess weight				
No	1			
Yes	1.11 (0.61-2.04)	0.73	Deleted	
Leisure-time physical activity				
Active	1			
Inactive	1.10 (0.49-2.46)	0.81	Deleted	
High blood Pressure				
No	1			
Yes	1.05 (0.48-2.25)	0.91	Deleted	
High Cholesterol				
No	1			
Yes	1.71 (0.58-5.02)	0.33	Deleted	
Diabetes				
No	1			
Yes	0.53 (0.11-2.63)	0.44	Deleted	

* Multivariate Analysis by binary logistic regression following a hierarchical model in three levels.

Its important to consider still consider that some variables related to personal (ownership of a driving license and motor vehicle) and environmental conditions (safety on public roads, availability of bike paths or lanes, traffic safety, existence of sidewalks, and walking trails) were not investigated. The distance from home to work is a factor that can interfere with the choices of physical activity in the domain of commuting, but unfortunately, we could not make this adjustment for potential confounding bias, because no data was collected on this variable. Previous studies indicated that larger distances between residences and the workplace reduced the opportunities for workers to walk or cycle (Badland et al., 2008; Badland et al., 2007). This limitation has been reported in similar studies due to the difficulty of obtaining reasonably accurate data, considering the discrepancy between the distances perceived by workers and those that were effectively covered (Yang and Diez-Roux, 2012; Badland et al., 2007).

To evaluate the public health recommendations regarding physical activity, it is important to determine frequency, intensity, and duration of an activity; however, the intensity and type of active commuting (walking or bicycling) were not collected, preventing the completion of important analysis, such as the stratification by type of commuting. These limitations need to be overcome in future studies, because international investigations (Yang et al., 2010; Rissel and Wen, 2008) have shown that commuting by bicycling is more beneficial to health than those performed by walking, possibly due to a dosage effect, since the energy cost and intensity of these two modes of traveling are quite distinct.

On the other hand, the caution adopted for standardization regarding the application of the questionnaire and the procedures for data entry are positive points that should be highlighted. The sample size also allowed for a reasonable statistical power to the analysis performed, and that factor combined with the aspect of choosing the subject ensures accuracy and representativeness for the study.

The results of the survey indicate that the prevalence of physical inactivity in commuting to work was high when compared with that observed in studies of Chinese (Hu et al., 2002) and Danish adults (Andersen and Haraldsdóttir, 1994), but was low when compared with American (Gordon-Larsen et al., 2009; Kruger et al., 2008) and Australian adults (Wen and Rissel, 2008).

In relation to national studies, we found that the prevalence of physical inactivity in commuting was lower than in Rio de Janeiro (Gomes et al., 2001) and Goiânia (Cunha et al., 2008; Peixoto et al., 2008), but was similar to that observed among workers in Pelotas (Bacchieri et al., 2005).

In the present study, gender did not discriminate the proportion of commuting physically inactive workers. Differing findings were observed in studies conducted by Bacchieri and collaborators (2005), Kruger and collaborators (2008), and Rissel and Wen (2008). However, these results differ from those that have been reported in a study conducted in Rio de Janeiro, which revealed that 7% of women and 9.6% of men reported walking or bicycling to school or work (Gomes et al., 2001).

To some extent, the results presented in this study regarding the socioeconomic factors associated with commuting physical inactivity converge to the evidence presented in the literature that, regardless of gender, the higher the family income and education level, the lower the frequency of the practice of physical activity in the domain of transportation. Hu and collaborators (2002) found that physical activity in the field of commuting was significantly higher among low-income individuals compared with those with higher incomes. Kruger and collaborators (2008) found that the prevalence of walking for transportation purposes was higher in lower income groups. Bacchieri and collaborators (2005) suggested that workers in lower socioeconomic levels view the bike a way of saving on the cost of purchasing and maintaining a car or even in relation to public transport.

Similarly, it was found that physical inactivity in commuting was directly associated with increased schooling. In the study by Mantilla-Toloza (2006), it was found that the proportion of individuals classified as insufficiently active was significantly higher among participants with higher education compared with those with an education equivalent to primary education.

The results the study show that physical inactivity for transportation purposes was directly

associated with an increased size of the company. It was observed that the frequency of downtime in commuting was higher among workers working in large industries when compared with those of medium and small industries. There are two possible explanations for this result: first, the large companies are located in areas that are remote from urban centers, and therefore its distance from residential areas may be too large to be created in a physically active commuting way, and second, because companies with the largest number of workers can provide transportation to the workplace, making it a less plausible option for physically active modes of travel.

In this study, physical inactivity in commuting was not associated with excess weight. Population--based studies conducted in several countries suggest that physical activity is inversely associated with excess weight, particularly in males (Gordon--Larsen et al., 2009; Kruger et al., 2008; Peixoto et al., 2008; Rissel and Wen, 2008). However, this association is unclear. The analysis of the different modes of commuting and the occurrence of excess weight and obesity among men and women is interesting and deserves further investigation.

It was also found that the physical activity in commuting was not associated with that during leisure time. Gordon-Larsen and collaborators (2009) found that walking during leisure time was positively associated with active commuting, with the strongest association observed among those who regularly walked compared with those who did not.

Few national studies evaluated the relationship of active commuting to health risk factors (Santos et al., 2009). In this study, high blood pressure and cholesterol were not identified as self-reported factors associated with physical activity in commuting. However, it was found that in male workers, those who reported having diabetes had lower odds of physical inactivity in commuting, when compared with those who did not. This is not to establish a causal relationship between these two factors, but international studies have shown that active commuting is related both to a reduced risk of diabetes in the general population (Hu et al., 2003) as well as containment of type 2 diabetes (Mantilla-Toloza, 2006). Franchi and collaborators (2008) found that 52.3% of diabetics regularly exercised when compared with non-diabetics (27.8%). These results show that individuals, who recognize the importance of physical activity, especially when they are sick, probably adopt a physically active lifestyle.

Therefore, we recommend the implementation of interventions in occupational settings and intersectoral public policies that may help these workers adopt a healthy and active lifestyle. Given the large proportion of physically inactive workers in commuting, it is believed that encouraging the use of bicycles as a mode of transport can be an important strategy to promote physical activity. Finally, it is recommended that in future research, the analysis of the association between physical activity in commuting with personal, environmental, and health-related factors can be stratified by types of commuting so as to clarify if the associated factors are distinct.

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