



Brief Original Report

Time spent traveling in motor vehicles and its association with overweight and abdominal obesity in Colombian adults who do not own a car



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ABSTRACT

Objective. This study examined associations between time spent traveling in motor vehicles per week (TSTMV) and BMI and abdominal obesity (AO) among Colombian adults residing in urban areas who do not own a car.

Method. Secondary data analysis of the 2005 National Nutrition Survey of Colombia was conducted. TSTMV was assessed using the long International Physical Activity Questionnaire. Body composition was measured in 7900 adults. Polytomous and binary logistic regressions were conducted, stratified by gender and adjusted for confounders, including physical activity (PA).

Results. Forty-two percent of participants were either overweight or obese according to their BMI, and 22.4% had AO. Males in the middle (10 to 149 min) and highest (> 150 min) TSTMV tertiles were more likely to be overweight (POR=1.58, 95% CI=1.13–2.21 and POR=1.55, 95% CI=1.12–2.15 respectively, *p*-trend=0.012), obese (POR=2.39, 95% CI=1.43–3.99 and POR=1.93, 95% CI=1.22–3.08 respectively, *p* trend=0.019) and to have AO (POR=1.81, 95% CI=1.18–2.78 and POR=1.73, 95% CI=1.18–2.54 respectively, *p*-trend=0.009). Associations were not significant in females.

Conclusions. TSTMV was positively associated with overweight and AO in adult Colombian males even after adjusting for PA. These findings highlight the potential deleterious health effects of sedentary behaviors such as prolonged traveling time, independently of having met PA recommendations.

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Introduction

Sedentary behaviors (SB) such as traveling for prolonged periods of time have health effects that are independent of overall physical activity (PA) and are significantly associated with abdominal obesity (AO), (Bertrais et al., 2005; Frank et al., 2004; Gao et al., 2007; Hamilton et al., 2008; Healy et al., 2008b; Hu et al., 2001; Jakes et al., 2003; Owen et al., 2010; Parra et al., 2009). Prior studies have identified a link between car ownership and increasing obesity (Bell et al., 2002; Parra et al., 2009). Likewise, small bouts of PA or breaks in sedentary time have been shown to provide beneficial effects in metabolic biomarkers (Healy et al., 2008a). This evidence supports the hypothesis that in addition to promoting healthy PA levels, limiting SB may also be a public health priority (Katzmarzyk et al., 2009; van der Ploeg et al., 2012).

A substantial proportion of the urban Latin-American population spends long periods of time travelling in motor vehicles, particularly in public mass transit systems as rates of private motor vehicle ownership remain relatively low (Rogat et al., 2009).

Despite mounting evidence from developed countries, little is known about the potential link between time spent travelling in motor vehicles per week (TSTMV) and obesity in Latin-America. Therefore, the aim of this study is to examine the associations between TSTMV and obesity, in a representative sample of Colombian adults residing in urban areas who do not own car, thus primarily including adults who use public transit systems.

Methods

Study design and data source

A secondary data analysis of the 2005 National Nutrition Survey of Colombia (ENSIN) was conducted. Technical details of ENSIN are available elsewhere (ICBF, 2005). This study used data from 7900 adults aged 18 to

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64 years from urban areas who had complete information for both outcome and exposure variables.

Outcome variables

Weight, height and waist circumference (WC) were evaluated by trained personnel using calibrated equipment and standardized measurement protocols (ICBF, 2005). Body mass index (BMI) was categorized according to WHO standards. AO was defined as a WC equal to or greater than 87 cm in women, and 97 cm in men, according to recent recommendations for Andean population (Medina-Lezama et al., 2010).

Exposure variables

TSTMV was assessed using questions culturally adapted from the long form of the International Physical Activity Questionnaire (IPAQ). These questions inquire about the frequency of PA and TSTMV such as bus, car, or motorcycle per week. Tertiles of TSTMV were calculated and the following categories were obtained: 1) less than 10 min, 2) 10 to 149 min, and 3) 150 min or more. Those who reported car ownership were not included in the analysis.

Covariates

We included sex, age, education level, socioeconomic status (SES) and PA level as covariates in the analysis. Variables were assessed via self-report. SES was established using a scoring system validated in Colombia that considers access to public utilities, with the following categories: low, middle-low and middle-high (DANE, 2005).

PA was measured through a culturally validated Spanish version of the long IPAQ, using the domains of leisure time and transportation (walking and bicycling) which have been recommended for use in the region (Hallal et al., 2010). PA level was classified in two categories: 1) meeting PA recommendations: engaging in at least 150 min of PA of moderate intensity or 75 min of vigorous intensity per week; and b) not meeting the PA recommendations aforementioned (DHHS, 2008).

Statistical analysis

The association between TSTMV and BMI categories was assessed using polytomous logistic regression, with normal and underweight combined as the reference category. A binary logistic regression was conducted to establish whether TSTMV was associated with AO. These models were stratified by sex and were adjusted by age, education levels, SES and PA level. All the statistical analyses took into account the complexity of sampling design using Stata 10 (StataCorp, 2007).

Results

The mean age was 32.9 years (SD = 13.1) and 62.2% were females. Around 29% reported TSTMV for 150 min or more per week, 42.5% of the sample was either overweight or obese according to BMI, and 22.4% had AO. Significant differences by gender were found in SES, PA levels, TSTMV, BMI categories and AO. Table 1 includes the descriptive characteristics of the sample.

Among males, those who reported TSTMV of 10 to 149 min, and 150 min or more, were more likely to be overweight (Prevalence Odds Ratio) (POR = 1.58, 95% CI = 1.13–2.21 and POR = 1.55, 95% CI = 1.12–2.15 respectively, p trend = 0.012) and obese (POR = 2.39, 95% CI = 1.43–3.99 and POR = 1.93, 95% CI = 1.22–3.08 respectively, p trend = 0.019) when compared to those who had normal or underweight BMI. In females no significant associations were detected for any of the outcome variables (Table 2).

Adult males, who reported TSTMV of 10 to 149, and 150 min or more, were more likely to have AO (POR = 1.81, 95% CI = 1.18–2.78 and POR = 1.73, 95% CI = 1.18–2.54, p trend = 0.009, respectively) compared to those who reported less than 10 min. These associations were not found in females (Table 2).

Table 1

Sociodemographic characteristics, time in motor vehicles per week, BMI, and waist circumference, National Nutrition Survey in Colombia – 2005. (n = 7900).

Variables	Frequency	Mean or %	Females	Males	p^a
<i>Gender</i>					
Male	2984	37.8			
Female	4916	62.2			
Age in years (SD)	7900	32.9 (14.8)	32.9 (13.1)	32.8 (13.2)	0.635
<i>Education level</i>					
Elementary school or less	2364	29.9	30.3	29.4	0.390
More than elementary school	5536	70.1	69.7	70.6	
<i>Socio economic status</i>					
Low	2270	28.7	27.5	30.7	0.021
Middle low	3240	41.0	41.6	40.0	
Middle	2185	27.7	28.3	26.6	
Middle upper	205	2.6	2.6	2.7	
<i>Physical activity</i>					
Meets recommendations	3831	48.5	40.9	60.9	<0.001
Does not meet recommendations	4069	51.5	59.1	39.1	
TSTMV in minutes (SD)	7900	171 (306)	130.8 (228)	237 (393)	<0.001
<i>TSTMV tertiles</i>					
Less than 10 min	2874	36.4	36.7	35.9	<0.001
10 to 149 min	2671	33.8	37.3	28.1	
150 min or more	2355	29.8	26.0	36.0	
<i>BMI categories</i>					
Normal or underweight	4540	57.5	54.8	61.8	<0.001
Overweight	2316	29.3	29.8	28.5	
Obesity	1044	13.2	15.4	9.7	
<i>Abdominal obesity</i>					
No	5916	77.6	73.3	84.4	<0.001
Yes	1706	22.4	26.7	15.6	
Missing values	278				

TSTMV, time spent traveling in motor vehicles per week.

BMI, body mass index.

^a p value of the difference between descriptive variables by gender. (Chi-square test and Wilcoxon Signed Rank Test were used for categorical and continuous variables, respectively).

Discussion

This study found that TSTMV is associated with overweight, obesity and AO in Colombian adult males residing in urban areas and who do not own a motor vehicle. These associations persisted even after adjusting for potential confounders, including SES and PA. These findings are consistent with those reported in previous studies (Frank et al., 2004; Parra et al., 2009; Wen et al., 2006). Even among those who do not own car, motorized forms of transportation such as mass transit systems increase time spent sitting, which can have deleterious effects on adiposity and metabolic health, even when public health recommendations for PA are met (Bell et al., 2002; Healy et al., 2008a), and therefore, suggesting that SB, including TSTMV, carries an independent risk to health that may not be completely offset by meeting current physical activity recommendations.

Mass transit systems have been recognized as an alternative to increase active transportation since people may walk or bike to and from the stations. However, evidence from this study seems to point to the fact that in the context of a Latin-American country like Colombia, prolonged travelling times in motor vehicles, including mass transit systems may have a deleterious effect on metabolic health, independent of meeting recommendations for physical activity.

This study found no association between TSTMV and measures of adiposity in females, for which there are several potential explanations.

Table 2

Polytomous and binary logistic regression between TSTMV and BMI and abdominal obesity categories stratified by sex. National Nutrition Survey in Colombia – 2005.

Polytomous logistic regression: TSTMV and BMI categories (n = 7900) ^a				
Time traveling in motor vehicles per week ^b	Overweight		Obesity	
	Adjusted POR (CI 95%)	p trend	Adjusted POR (CI 95%)	p trend
<i>Men^c n = 2984</i>				
Less than 10 min	Ref		Ref	
10 to 149 min	1.58 (1.13–2.21)	0.012	2.39 (1.43–3.99)	0.019
150 min or more	1.55 (1.12–2.15)		1.93 (1.22–3.08)	
<i>Women^c n = 4916</i>				
Less than 10 min	Ref		Ref	
10 to 149 min	1.16 (0.93–1.46)	0.541	1.14 (0.84–1.56)	0.606
150 min or more	1.09 (0.85–1.39)		0.91 (0.66–1.28)	
Binary logistic regression: TSTMV and abdominal obesity (n = 7622)				
Time traveling in motor vehicles per week ^b	Adjusted POR (CI 95%)		p trend	
<i>Men^c n = 2967</i>				
Less than 10 min	Ref		0.009	
10 to 149 min	1.81 (1.18–2.78)			
150 min or more	1.73 (1.18–2.54)			
<i>Women^c n = 4655</i>				
Less than 10 min	Ref		0.123	
10 to 149 min	1.01 (0.79–1.30)			
150 min or more	0.80 (0.60–1.06)			

TSTMV, time spent traveling in motor vehicles per week.

^a The polytomous logistic regression assumed the categories normal and underweight as the reference category.

^b Among adults who do not own a car.

^c Adjusted by age, education levels, Socio economic status and physical activity levels.

First, the prevalence of AO and overweight in females may be more associated with other factors than vehicle use. A study in which PA was measured by accelerometry (Healy et al., 2007), found that women spent less time in sedentary activities, and engage in more light-intensity PA than men. Both behaviors can contribute to increased overall daily energy expenditure (Healy et al., 2008b; Owen et al., 2010), which can prevent weight gain. Another potential explanation is that the self-report instrument used in the present study may not have accurately captured the TSTMV in females.

Strengths of this study include the use of a nationally representative sample, the ability to adjust results by PA level, and the objective determination of the outcome variables using standardized protocols.

Some limitations of this study deserve mentioning. First, the cross sectional nature of the study does not allow determining any cause-effect relationship. Second, the question used to establish TSTMV did not assess whether participants' mass transit rides were made predominantly sitting or standing. Further studies should be conducted in order to better understand these relationships.

Conclusion

TSTMV is associated with overweight, obesity and AO among Colombian adult males residing in urban areas and who do not own a car. Therefore, public health guidelines should also emphasize the limiting of SB as well as increasing physical activity.

In addition, and due to the significant proportion of the Latin-American population that uses motor vehicles in their daily lives

and the current trends in urban growth, it is important to highlight the need for transportation and urban design policies that not only encourage active transportation but also reduce travel times.

Conflict of interest statement

The authors declare no conflict of interest.

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