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Prevalence and Predictors of Physical Inactivity in a Slum in Brazil

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ABSTRACT *The aim of this study was to ascertain the prevalence of physical inactivity and examine the role of potential predictors in a very low-income adult population in a slum located in Recife city, northeast of Brazil. A cross-sectional study was conducted with 1,176 subjects aged 20–60 years residing in a slum. Using the short version of the International Physical Activity Questionnaire, 307 (26.1%) study participants—97 (23.8%) men and 210 (27.3%) women—have a low physical activity score (MET-minutes per week). Increased age was associated with physical inactivity only in people without overweight/obesity. Low physical activity was less common (i.e., respondents were more active) than in other Brazilian population-based studies. These results suggest that the relationship between physical activity and socioeconomic level is more complex and depends on the internal characteristics of the community.*

KEYWORDS *Physical activity, Poverty areas, Slum*

INTRODUCTION

The global epidemic of obesity and comorbidities is spreading more quickly in developing countries.[1–3] Low-cost high-energy diets and lack of physical activity have been associated with overweight and obesity in poor people.[4,5] Some studies in developed countries have shown that physical inactivity is more prevalent among poor people.[6,7] However, few studies have investigated physical activity among poor people living in developing countries.[8,9]

Brazil has recently experienced a marked increase in the incidence of obesity and its comorbidities.[10] The epidemiological transition, characterized by lower levels of physical activity and a more unhealthy diet, has been held responsible for these changing trends.[10,11] At the same time, there has been intensive migration of the Brazilian population from rural to urban areas; in the 1960s, around 80% of the population lived in the countryside, compared to only 20% today.[12,13] This migration has been responsible for the creation of slums in urban regions of Brazil that have expanded greatly, especially in the last 2 decades.[14] Slums are usually characterized by poor housing, overcrowding, poor sanitary conditions and high rates of poverty and unemployment.[13] Some recent studies have found a very high prevalence of overweight and obesity in this population.[15,16] However, the prevalence of physical inactivity among low-income populations, and its predictors,

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has been little studied. The aim of this paper was to report the prevalence of physical inactivity and its correlates in a very low-income slum population.

METHODS

The study was conducted in the slum of Caranguejo, in the city of Recife, in the Northeast Region of Brazil. Recife has a population of 1,422,905 and 54.9% of its inhabitants live in slums.[17]

The per capita income of the Caranguejo slum is around US $1 per day; basic sanitation, such as sewage treatment and piped water, does not exist. As of 2009, the estimated population of the slum was 3,733 inhabitants (1,963 women), made up of 1,643 children and young people (aged 0–19 years), 1,888 adults (aged 20–59 years) and 202 elderly people (aged 60 and above). Attempts were made to recruit a sample of 1,297 of the 1,888 adults in the 20- to 59-year-old age group (mean=37.0, SD=11.8) who had been registered by the Family Health Program (FHP) in the slum. The FHP, set up in 1994 by the Brazilian National Health System, is the main primary health care strategy providing a full range of quality health care to families in their homes. The FHP is active in nearly all of Brazil's 5,560 municipalities, each serving up to about 2,000 families. Family Health teams include doctors, nurses, dentists, and other health workers. Health workers live locally and are chosen by the community they serve; they are easily accepted by their peers and have natural cultural awareness.

Visits were made to all households during the study. Researchers were accompanied by a health worker on these visits for reasons of security since the slum is an area with a high rate of violent crime. If the participant was not home at the time of the first visit, 2 further attempts were made. The study protocol was approved by the Instituto de Medicina Integral Prof. Fernando Figueira's (IMIP) Ethics Committee. Written informed consent was obtained from all study participants.

Assessment of Physical Activity

Following training, community health workers administered the International Physical Activity Questionnaire (IPAQ) (www.ipaq.ki.se/ipaq.htm), short form version, as developed with the support of the World Health Organization and the Centers for Disease Control. The IPAQ collects information on physical activity undertaken in the course of leisure time, work time, transport and housework. The instrument contains questions related to frequency (days per week) and duration (time per day) of walking and moderate and vigorous physical activity. Moderate physical activity is defined as that which requires some physical effort, making the individual breathe a bit harder than normal, with the heart beating a little faster; vigorous physical activity is defined as the type of exertion requiring intense physical effort, making the individual breathe harder than normal, with the heart beating faster. The validity and reliability of the IPAQ has been tested in several settings, including a Brazilian population,[18] and it has been concluded that it compares favorably with other such devices.

The physical activity score was calculated and expressed in MET-minutes per week according to the IPAQ MET-scoring method (http://www.ipaq.ki.se/scoring.pdf). Three levels of physical activity were adopted: low, moderate and high. Low physical activity was classified as no reported activity or some activity but not enough to be described as moderate or high. Moderate physical activity met either of the following 3 criteria: 3 or more days of vigorous activity lasting at least 20

minutes per day, or 5 or more days of moderate-intensity activity and/or walking at least 30 minutes per day, or 5 or more days of any combination of walking and moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes/week. A high level of physical activity was considered to be a level meeting the following 2 criteria: vigorous activity on at least 3 days and accumulating at least 1,500 MET-minutes/week, or 7 or more days of any combination of walking and moderate- or vigorous-intensity activities accumulating at least 3,000 MET-minutes/week.

Assessment of Predictor Variables

Study participants also responded to questions regarding age, gender, skin color, domestic partnership status, level of education, "per capita" income and hours of TV viewing/day. Weight and height were measured by trained personnel using standard techniques. Body mass index (BMI, kg/m^2) was calculated as weight in kilograms divided by the square of height in meters. Overweight was defined as a BMI of 25.0–29.9 and obesity as a BMI of 30.0 or higher.

Statistical Analyses

The Student's *t* test was used to compare the means of MET between men and women. The association between independent variables and physical inactivity was examined using Poisson regression, with robust standard errors. Prevalence ratios with accompanying 95% confidence intervals were reported in univariate and multivariate analyses. Those variables with a p value <0.20 for univariate analysis were selected for multivariate analysis. Multivariate Poisson regression was used to assess the independent contribution of these variables to the prevalence of physical inactivity. All statistical analyses were carried out using the Stata 9.2 software.

RESULTS

Of the 1,297 people eligible for the study, 1,176 (90.9%) actually took part: 769 (65.3%) women and 407 men (34.7%). Reasons for the non-participation of 118 adults included not being at home at the time of all 3 daytime home visits (N=87), refusal to participate (N=19), inability to locate the individual (N=9), and other reasons (N=3). Non-respondents were more likely to be men (70.2%). Almost 65% of participants were female, and 60.1% were aged between 20 and 40 years. The mean age was 37.0 (SD=11.7)years for women and 37.1 (SD=11.9)years for men (2-tailed Student's *t* test: p=0.920). Three cases with a total of all walking and moderate and vigorous physical activity time >960 min were excluded from the analysis.

The prevalence of the various levels of physical activity were: low 26.1% (95%CI = 23.6–28.6%), moderate 26.8% (95%CI = 24.2–29.1%) and high 47.0% (95%CI = 44.4–50.1%). Because the survey overrepresented females and underrepresented males in the population, a weight was used to compensate for this bias, but with a very low impact on the prevalence of physical inactivity, changing it to 25.6% (95%CI = 23.1–28.1%). The mean physical activity score (MET per week) was higher in men (Student's *t* test: p=0.002; Table 1).

Table 2 shows the association between physical inactivity and a range of factors. In unadjusted analyses, there was a suggestion that being overweight (RP=1.98; 1.63–2.39) was associated with an increased risk of being physically inactive. Increased age was also related to physical inactivity in a stepwise manner across the age groups. There was no evidence that sex, ethnicity, income, education, and time

TABLE 1 Physical activity patterns in adult men and women residents in a slum

Physical activity score	Men ($N=40$)	Women ($N=769$)	Whole sample ($N=1,176$)
Mean score (MET/week)	2,007	1,679	1,787
Standard deviation (MET/week)	1,917	1,364	1,585
Percentiles			
25th (MET/week)	600	480	544
50th (MET/week)	1,390	1,428	1,427
75th (MET/week)	3,024	2,314	2,518
Skewness	1.31	1.42	1.50
Minimum (MET/week)	0	0	0
Maximum (MET/week)	10,080	9,912	10,080
Categorical score of physical[a] activity			
Low	97 (23.8)	210 (27.3)	307 (26.1)
Moderate	114 (28.8)	202 (26.3)	316 (26.0)
High	196 (48.2)	357 (46.4)	553 (47.0)

[a]*Low*: no activity is reported OR some activity is reported but not enough to meet categories 2 (moderate) or 3 (high). *Moderate*: either of the following 3 criteria—3 or more days of vigorous activity of at least 20 min per day OR 5 or more days of moderate-intensity activity and/or walking of at least 30 min per day OR 5 or more days of any combination of walking, moderate-intensity of vigorous-intensity activities achieving a minimum of at least 600 MET-min/week. *High*: Any 1 of the following 2 criteria—vigorous-intensity activity on at least 3 days and accumulating at least 1,500 MET-min/week OR 7 or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3,000 MET-min/week

spent viewing television were related to physical inactivity. In multivariable analyses, the association of age and overweight/obesity with physical inactivity persisted, albeit slightly less pronounced, as a result of a significant interaction between BMI and age ($p<0.001$, Table 3). Increased age remained associated with physical inactivity in people with BMI ≤ 25 kg/m^2, but the data show no significant relation between age and physical inactivity in people with overweight/obesity.

DISCUSSION

The aim of this study was to ascertain the prevalence of physical inactivity in a very low-income population and to investigate the relationship between physical inactivity and a range of potential predictor variables. A low prevalence of physical inactivity (26.1%) and a large number of individuals with high levels of physical activity (47.0%) were found. This result suggests that the patterns of physical activity in this very poor community are not the same as in populations with a different socioeconomic status in Brazil. In very low-income areas, in particular, household chores, transportation, and work activities may represent a substantial proportion of individuals' total activity. A large number of the individuals studied were unemployed, occasionally doing hard work at a location far removed from their residence, thus requiring long hours of walking. No other studies were found that have studied levels of physical activity in very poor communities. Studies in Brazil that include all social classes have reported a higher level of physical inactivity. Hallal et al.[18] found a rate of 41.1% for physical inactivity in a representative sample from the city of Pelotas, in the south of Brazil. Likewise,

TABLE 2 Prevalence ratios (95%CI) for the relation of demographic and socioeconomic variables with physical inactivity—the Caranguejo Study

	Physical inactivity				
	Yes	No	Total	PR crude	*p*
Sex					0.201
Male	97 (23.8)	310 (76.2)	407	1.0 (ref)	
Female	21 (27.3)	559 (72.3)	769	1.15 (0.93–1.41)	
Age (years)					<0.001
20–30	54 (13.8)	336 (86.2)	390	1.0 (ref)	
30–40	88 (27.8)	229 (72.2)	317	2.00 (1.48–2.72)	
40–50	80 (34.6)	151 (65.4)	231	2.50 (1.84–3.39)	
50–60	85 (35.7)	153 (64.3)	238	2.58 (1.91–3.48)	
Time spent in education (years)					0.850
>8	108 (26.3)	303 (73.7)	411	1.0 (ref)	
4–8	162 (26.8)	443 (73.2)	605	1.02 (0.83–1.26)	
<4	37 (23.1)	123 (76.9)	160	0.88 (0.64–1.22)	
Ethnicity					0.495
White	159 (25.8)	458 (74.2)	617	1.0 (ref)	
Mixed	93 (28.3)	236 (71.7)	329	1.1 (0.88–1.36)	
Black	55 (23.9)	175 (76.1)	230	0.93 (0.71–1.21)	
Partner status					0.158
Marriage	192 (26.1)	545 (73.9)	737	1.0 (ref)	
Single	96 (24.8)	291 (75.2)	387	0.95 (0.77–1.18)	
Widower	19 (36.5)	33 (63.5)	52	1.40 (0.96–2.05)	
Income per capita (US $)					0.556
≤1	240 (25.7)	693 (74.3)	933	1.0 (ref)	
>1	67 (27.6)	176 (72.4)	243	1.07 (0.85–1.35)	
Time spent TV viewing (h)					0.311
<1	140 (26.1)	396 (73.9)	536	1.0 (ref)	
1–3	82 (29.1)	200 (70.9)	282	1.11 (0.88–1.40)	
>3	85 (23.7)	273 (76.3)	358	0.91 (0.72–1.15)	
BMI (≤25 kg/m^2)					<0.001
≤25	207 (21.9)	738 (78.1)	945	1.0 (ref)	
>25	100 (43.3)	131 (56.7)	231	1.98 (1.63–2.39)	

PR prevalence ratio

Matsudo et al.[19] reported a rate of 46.5% in a sample representative of the State of São Paulo, in the southeast.

The hypothesis of the present study was that living in a slum may lead to physical inactivity, which is, in turn, a risk factor for obesity and its comorbidities. However, little is known about the physical activity habits of people who live in very deprived regions in developing countries. As traditionally poor countries develop, there is a trend for individuals living in the countryside to migrate to urban areas,[20,21] and the process of urbanization is linked to changes in food habits and behavior. In Brazil, this migration has been especially intensive in the last few decades, and at present, even though Brazil is still an agricultural country, only 20% of the population lives in rural areas.[13] People who leave the countryside often have no social or economic alternative but to settle in slums. Because of overcrowding, poor sanitary conditions, and substandard living conditions, infections and chronic

TABLE 3 Prevalence ratios (95%CI) for the relation of demographic variables with physical inactivity—the Caranguejo Study

		Physical inactivity				
	Age (years)	Yes, *n* (%)	No, *n* (%)	Total, *n*	PR	*p*
BMI≤25 kg/m^2	20–30	46 (12.5)	321 (87.5)	367	1.0 (ref)	<0.001
	30–40	60 (22.3)	209 (77.7)	269	1.78 (1.25–2.53)	
	40–50	53 (32.9)	108 (67.1)	161	2.63 (1.85–3.72)	
	50–60	48 (32.4)	100 (67.6)	148	2.59 (1.81–3.70)	
BMI>25 kg/m^2	20–30	8 (34.8)	15 (65.2)	23	1.0 (ref)	0.076
	30–40	28 (58.3)	20 (41.7)	48	1.68 (0.91–3.08)	
	40–50	27 (38.6)	43 (61.4)	70	1.11 (0.59–2.09)	
	50–60	37 (41.1)	53 (58.9)	90	1.18 (0.64–2.18)	

PR prevalence ratio

diseases are on the increase in slums. Obesity-related comorbidity is also spreading more rapidly in poor areas of Brazil than in developed regions.

Studies in developed countries have recognized that physical activity is less frequent in populations of lower socioeconomic levels, especially physical activity during leisure time.[6,7] The slum studied had a high population density and no spaces devoted to physical leisure time activities. Furthermore, this type of physical activity often requires financial investment, such as attending gyms, acquiring sportswear and so forth, which lies beyond the means of the population under study.

Traditional explanations for the increase in obesity include reduced physical activity and consumption of high-fat diets.[22,23] The results presented here suggest that physical inactivity does not seem to be the most important risk factor for obesity among this very low-income community. The types of food most commonly consumed by the population under study (data not shown) were lower cost ones, which usually contain high levels of saturated fat or simple carbohydrates. It is thus a reasonable assumption that high-calorie diets play a greater role in generating obesity in this population than physical inactivity.

The population studied here is subject to constant nutritional risk and recognized as living on or below the poverty line of US $1 per day calculated by researchers at the World Bank. To the authors' knowledge, this is the first study to use IPAQ in a very low-income population to investigate the prevalence of inactivity and associated variables.

One of the methodological strengths of this study was the high degree of similarity across the sample with regard to socioeconomic characteristics. The study also investigated 4 significant components of an individual's level of activity (leisure, paid work, housework, and transportation); the IPAQ short-form asks about 3 specific types of activity undertaken in the 4 domains. Studies that assess physical leisure time activity tend to underestimate the level of physical activity engaged in by individuals of lower socioeconomic status, such as the members of the population studied here.

Despite these strengths, several limitations should also be acknowledged. For instance, we studied a great number of women because more men were at work and therefore absent from home during data collection time. Even with this selection bias, we found lower levels of physical activity among women. It was not possible to determine with precision the level of employment because although most of the people were unemployed, they often had some kind of informal work. The short version of the IPAQ, although it addresses the 4 components of physical activity, does not allow us to

distinguish between leisure, paid work, housework and transportation activities, as would be useful for understanding patterns of behavior in the slum. It is recommended that the long version of the IPAQ be used to investigate this.

A larger number of women were studied because the adult male population had more odd jobs or some kind of informal work and were thus more frequently away from home. Since the questionnaires were not self-administered, owing to the high level of illiteracy in the population under study, they were applied by community health workers. Home visits were made in the mornings and the afternoons, contributing to a lower coverage of the male population.

The positive association between the total prevalence of inactivity and age is consistent with the literature.[24] There was a marked decline in the levels of activity after 30 years, which may be attributable to an increasingly sedentary lifestyle being adopted later in life. Job opportunities for this population are usually associated with physical activity because of their low level of education. The employment market thus prefers younger people because aging is associated with reduced physical performance.

The relationships between inactivity and obesity are fully described in the literature.[25] The BMI does not measure how fat a person is per se, and exercise may stimulate muscle growth. Furthermore, a cross-sectional design is not appropriate for studying this association. The causative role of physical inactivity in the aetiology of overweight and obesity is fully described in the literature.[26,27]

In developed countries, underprivileged communities have higher morbidity and mortality rates for chronic diseases than the national averages. The same is to be expected in developing countries undergoing the epidemiological transition, but there are few studies in these settings that identify the role of physical activity. Extrapolation of the results presented here to other populations should be considered with due care. Although Brazil is a large country and some regions may have different physical activity patterns, a similar scenario is likely to be faced by most parts of the country within the next couple of decades.

In conclusion, the prevalence of physical inactivity in this very low-income Brazilian adult population is lower than in the population with less adverse socioeconomic conditions. However, this level of inactivity is still a cause for considerable concern, given the association between poor socioeconomic conditions and non-transmissible chronic diseases. These results, however, suggest that the relationship between physical activity and socioeconomic level is more complex and depends on the internal characteristics of the community.

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