Physical Inactivity: Prevalence and Associated Variables in Brazilian Adults

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ABSTRACT

HALLAL, P. C., C. G. VICTORA, J. C. K. WELLS, and R. C. LIMA. Physical Inactivity: Prevalence and Associated Variables in Brazilian Adults. *Med. Sci. Sports Exerc.*, Vol. 35, No. 11, pp. 1894–1900, 2003. **Purpose:** To measure the prevalence of physical inactivity, and variables associated with it, in an adult southern Brazilian population. **Methods:** Population-based cross-sectional study covering a multiple-stage sample of 3182 subjects aged 20 yr or more. Physical activity was assessed through the short version of the International Physical Activity Questionnaire (IPAQ), using home interviews with last-week recall. The questionnaire covers leisure, occupation, transportation, and housework activities. Physical inactivity was defined as fewer than 150 $min \cdot wk^{-1}$ spent in moderate or vigorous physical activities. The time spent in vigorous activities was multiplied by two. **Results:** The prevalence of physical inactivity was 41.1%. After multivariate analyses, inactivity was positively associated with age and socioeconomic status, and inversely associated with self-reported health status. Those with white skin color and women who live alone rather than with a partner were more likely to have physical inactivity. Body mass index showed a significant U-shaped relationship with inactivity among men. **Conclusion:** The prevalence of physical inactivity in this Brazilian adult population is high, even though lower than reported in studies of leisure-time activity alone in other populations. Studies in developing countries may be seriously biased if activities during labor, transportation, and housework are not assessed. **Key Words:** EXERCISE, EPIDEMIOLOGY, DEVELOPING COUNTRIES, CROSS-SECTIONAL STUDIES, SEDENTARISM, PHYSICAL ACTIVITY

In many countries, the profile of morbidity and mortality changed greatly during the 20th century, with a decrease in the frequency of infectious diseases and an increase in lifestyle-related diseases (21). This phenomenon, known as the epidemiological transition, has changed the focus of epidemiological research. The risk factors associated with chronic diseases have been investigated in numerous epidemiological studies, which have provided evidence of the importance of physical activity as a preventative factor (5,19,23,25). Even relatively minor modifications, such as encouragement of active forms of transportation, have potential benefits against obesity, for example (4). In addition to its preventative role, physical activity is also recommended as an intervention to treat various diseases (1,14).

Measurement of physical activity level is therefore increasingly important in the context of public health. However, the literature shows that more than 30 methods have already been used to assess this parameter (17), making it difficult to compare the results. Due to feasibility and cost constraints, most epidemiologists have opted to use questionnaires for this purpose, and many such questionnaires are available (16). Appreciation of these two factors, the increasing interest and the difficulty of measurement, stimulated the creation of a standardized questionnaire to evaluate physical activity in population studies worldwide.

The International Physical Activity Questionnaire (IPAQ; www.ipaq.ki.SE) was therefore developed by researchers from various countries, with the support of the World Health Organization (WHO) and the Centers for Disease Control (CDC). Several versions of the questionnaire were created, according to the number of questions (long or short), the recall period (usual week or last 7 d) and the method of application (self-administered, or telephone or face-to-face interview) used. The IPAQ working group recommended face-to-face interviews only for developing countries.

Whereas in developed countries population-based studies on physical inactivity and associated variables have already been conducted (7,8,20), in many developing countries such data are lacking. Some epidemiological analyses already undertaken in Brazil have addressed this issue (3,9,10). However, data from these studies are restricted to specific groups, such as industrial workers (3) or adolescents (9). Other investigations (10) addressed only leisure-time activities. To the authors' knowledge, no population-based study of physical inactivity has been conducted in Brazil addressing the four significant components of an individual's activity level (leisure, occupation, housework, and transportation).

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TABLE 1. Comparison between the city (Pelotas) and the whole country (Brazil) socioeconomic, health-related, and demographic variables.

Variable*	Pelotas	Brazil
Sex (including all ages)		
Men	48.8%	49.2%
Women	51.2%	50.8%
Mean monthly income (head of the family)	US$ 44.9	US$ 43.0
Gini index (income inequality)	0.60	0.64
Schooling (yr)		
0–3	27.7%	41.1%
4–10	55.8%	45.1%
11 or more	16.5%	13.8%
Infant mortality rate	20	29

* Sources: Brazilian Institute of Geography and Statistics (sex, monthly income, Gini index, and schooling) and local/national surveys (infant mortality rate).

This study was motivated by the availability of a standardized questionnaire to assess physical activity, which would provide comparable prevalences of inactivity worldwide, as well as by the paucity of studies addressing the four components of physical activity, specially in Brazil. The objective of this study was to determine the prevalence of physical inactivity, and the variables associated with it, in a representative sample of adults resident in Pelotas, Brazil.

MATERIALS AND METHODS

Pelotas is an extreme southern Brazilian city, which comprises approximately 320,000 inhabitants, 93.2% of whom live within the urban area (12). A cross-sectional study was conducted with the target population including adult (20 yr or more) residents in Pelotas. Table 1 provides a comparison between Pelotas and the whole country for demographic, health-related, and socioeconomic characteristics.

The sampling process was undertaken in several stages. First, all 281 census tracts were listed and divided into four groups according to the average schooling level of the family head (group 1: average less than 4 yr; group 2: between 5 and 8 yr; group 3: between 9 and 11 yr; and group 4: 12 yr or more) (13). Within each category, we sampled census tracts with probability proportionate to size. All the households of each sampled tract were listed, and the houses to be visited were systematically selected ($N = 1600$ households). All the occupants of sampled households aged 20 yr or more were eligible for the study. Subjects who refused to respond or who were not home at the time of the first visit were sought on at least two other occasions.

To assess physical activity level, the official Portuguese short version of IPAQ (available at: www.celafiscs.com.br) was applied at face-to-face interviews, with a recall period of the previous 7 d. The physical activity score was calculated as the sum of minutes of moderate activity (including fast and moderately fast walking) plus twice the minutes of vigorous activity. IPAQ defines moderate activities as those that produce a moderate increase in respiration rate, heart rate, and sweating for at least 10 min of duration. Vigorous activities are defined as those producing vigorous increases in the same variables. Inactivity was defined as a score below 150 $min \cdot wk^{-1}$, in accordance with the recommendations from the U.S. Surgeon General's Report (27), American College of Sports Medicine (ACSM), and CDC (22).

To investigate the independent variables, a standardized and pretested questionnaire was used. These variables were sex, age, skin color (divided into white or nonwhite as observed by the interviewer), partner status (living with or without a partner), body mass index (BMI, calculated using self-reported weight and height), and self-reported health status (excellent, very good, good, average, or poor). Obesity was defined as BMI equal to or above 30 $kg \cdot m^{-2}$, overweight as BMI between 25 and 29.9 $kg \cdot m^{-2}$, normal as BMI between 18.5 and 24.9 $kg \cdot m^{-2}$, and chronic energy deficiency as BMI below 18.5 $kg \cdot m^{-2}$. Social status was evaluated using the classification of the Brazilian National Association of Research Institutes (ANEP), divided in five categories, where A is the highest group (2). This classification considers both household assets (such as car, television, washing machine, etc.) and education of the head of the household. The questionnaire and its guidelines were tested twice in pilot studies conducted in census tracts not included in the final sample.

To estimate a prevalence of physical inactivity of 50% (±5%), it would be necessary to interview 846 subjects, whereas to explore the association between physical inactivity and the independent variables, it would be necessary to interview 1418 individuals. Both calculations used the following parameters: confidence level of 95% and excess to nonresponse of 10%. The latter included a power of 90%, excess to multivariate analysis of 15%, and relative risk to be detected of 1.7 or higher. The actual sample included 3182 individuals because this study was part of a larger investigation on general health, including other outcomes that required larger samples.

Interviewers were women, with at least secondary education. They were trained for 40 h in the application, completion, and codification of the questionnaire, and they were blinded to the objectives and hypotheses of the investigation. Interviewers were trained to introduce themselves politely to the families and to conduct the interviews in a separate part of the house in order to avoid interference from family members. Fieldwork supervisors conducted repeat interviews in 10% of the sample, randomly selected, asking only selected questions from the full questionnaire in order to conduct quality control.

Data entry was undertaken twice, with automatic checks for consistency and range. The initial analysis described the sample in terms of physical activity patterns, and socioeconomic, demographic, behavioral, and health-related variables. Next, a crude analysis was conducted comparing the prevalence of physical inactivity according to each independent variable. For the multivariate analysis, a Poisson regression model was used to provide estimates of adjusted prevalence ratios. All the analyses took into account the cluster sample. Furthermore, both full and sex-specific analyses were undertaken.

Multivariate analysis was conducted using a hierarchical approach (28) with the model incorporating three levels: the distal, including sex, age, and skin color; the intermediate, including social status and partner status; and the proximal, including BMI and self-reported health status. This type of

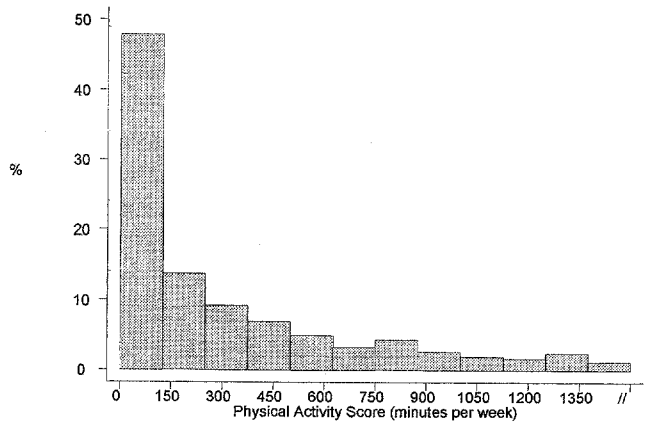

FIGURE 1—Distribution of the physical activity score (min·wk^{-1}) in adults (Pelotas, Brazil, 2002). // The x-axis is interrupted at 1500 min, as such the graph does not show data above this value (17.5% of the sample, N = 547, maximum value 5260 min·wk^{-1}). The omitted blocks continue to decline asymptotically toward this value.

analysis (28) adjusts the effect of each variable for those in the same level or above in the model. In addition, a one-step regression was conducted in order to compare the results with the hierarchical approach.

The Ethical Committee of the Federal University of Pelotas approved the study protocol and data were made anonymous before analysis. Informed consent was obtained from each subject.

RESULTS

Among the 1600 selected households, there were 3372 people eligible for the study, of who 3182 agreed to answer the questionnaire, with a nonresponse rate of 5.6%. Nonrespondents did not differ from respondents according to sex or age, and no important differences were observed among census tracts (an indicator of socioeconomic status). Of the 3182 individuals interviewed, 63 failed to provide adequate data on physical activity, so analyses were conducted on a maximum of 3119 data points. Data were classified as inadequate when the answer to one or more IPAQ questions was missing.

The distributions of physical activity scores were markedly positively skewed (Fig. 1), and almost identical for men and women (data not shown). Whereas 839 individuals (26.4%) scored 0 minutes of activity per week, 761 (23.9%) scored 1000 or more minutes per week. Using a cutoff score of 150 min·wk^{-1}, the prevalence of physical inactivity in this sample was 41.1% ($CI_{95\%}$ 39.4, 42.8%). Detailed data on physical activity patterns of the whole sample and according to gender are provided in Table 2.

The description of the independent variables indicated that 56.8% of the sample were women, 18.4% were elderly (60 yr or more), 84.7% were classified as having white skin color, 61.3% lived with a partner, 36.4% were of social status D or E, 14.3% were obese, and 28.2% classified his/her own health as poor or average. The maximum number of missing values was 135 (BMI), whereas all other variables had fewer than 20 values missing.

TABLE 2. Description of physical activity patterns in Brazilian adults (Pelotas, Brazil, 2002).

Parameter	Whole Sample	Men	Women
Mean score (min·wk^{-1})	748.9	797.9	711.7
Standard deviation (min·wk^{-1})	1082.8	1142.2	1034.0
Percentiles			
25th (min·wk^{-1})	0	0	0
50th (min·wk^{-1})	240	270	240
75th (min·wk^{-1})	952	980	900
Skewness	1.8	1.7	1.8
Percentage with score = 0 min·wk^{-1}	26.4%	25.3%	27.2%
Minimum (min·wk^{-1})	0	0	0
Maximum (min·wk^{-1})	5160	5160	4620

In the crude analysis, physical inactivity prevalence was positively associated with age and social status and inversely related to self-reported health status. White individuals had a 25% higher prevalence compared with nonwhites (P = 0.01), but there were no significant differences in relation to sex, partner status, and BMI. The multivariate analysis confirmed the effects of age, skin color, social status, and self-reported health status.

Separate analyses according to gender (Tables 3 and 4) confirmed most of the associations observed in the general analysis, but some differences were noted. Skin color was not significantly associated with physical inactivity prevalence in women. Body mass index was not related to the outcome in women but showed a significant U-shaped association in men. Men classified as obese or chronic energy deficient were more likely to have physical inactivity. Living without a partner was associated (P = 0.02) with a higher prevalence of physical inactivity in women, but no significant effect was observed in men. A significant trend between category of self-reported health status and prevalence of physical inactivity was observed in men (P = 0.009) but not in women (P = 0.5).

Additional analyses investigating associations between physical inactivity prevalence and smoking behavior or religious practice failed to show significant results. The prevalences of physical inactivity were: 42.8% among those who do not practice any religion; 40.1% among Catholics, 36.4% in Evangelicals, 42.3% in Spiritualists, and 40.2% among the remainder who could not be classified in the previous categories (P = 0.2). The results for smoking behavior were prevalences of physical inactivity of 41.9% (never smoked), 43.5% (ex-smoker), 37.6% (moderate smoker), and 38.4% (heavy smoker) (P = 0.1).

Quality control was assessed by reinterviewing 337 subjects. It was not feasible to repeat the whole questionnaire, and thus the repeatability of self-reported health-status was tested. The weighted-kappa value was 0.60. In addition to the hierarchical approach, a one-step multivariate analysis was carried out in which all independent variables were entered simultaneously. There were only minor differences in the adjusted prevalence ratios. Furthermore, all analyses were repeated using logistic regression, and again the variables associated with inactivity remained the same, but in this case with severe overestimates of the actual prevalence ratios by the odds ratios, as expected because baseline prevalence of inactivity was high (15).

TABLE 3. Description of the male sample in terms of demographic, socioeconomic, and behavioral variables, with crude and adjusted prevalence ratios for each independent variable in relation to the outcome (physical inactivity; Pelotas, Brazil, 2002).

Level[a]	Variable[b]	N	% Physical Inactivity	Crude Analysis		Multivariate Analysis	
				PR[c] (CI[d] 95%)	P	PR (CI 95%)	P
	Age (yr)				0.002[f]		0.002[f]
1	20–29	334	38.2	1.00		1.00[g]	
	30–39	313	35.2	0.92 (0.74, 1.14)		0.92 (0.75, 1.13)	
	40–49	291	38.3	1.00 (0.83, 1.22)		1.00 (0.82, 1.21)	
	50–59	213	43.4	1.14 (0.92, 1.41)		1.12 (0.90, 1.39)	
	60–69	124	44.6	1.17 (0.89, 1.54)		1.17 (0.89, 1.54)	
	70 or more	99	57.0	1.49 (1.18, 1.89)		1.47 (1.16, 1.87)	
	Skin color				0.04[e]		0.06[e]
1	White	1170	41.5	1.26 (1.01, 1.59)		1.25 (0.99, 1.60)	
	Nonwhite	204	32.8	1.00		1.00[g]	
	Partner status				0.1[e]		0.6[e]
2	With partner	952	41.8	1.14 (0.98, 1.33)		1.04 (0.89, 1.21)	
	Without partner	422	36.6	1.00		1.00[h]	
	Social status[j]				0.005[f]		0.006[f]
2	A (highest)	73	47.2	1.51 (0.93, 2.43)		1.47 (0.91, 2.37)	
	B	263	46.3	1.48 (0.94, 2.30)		1.46 (0.94, 2.24)	
	C	543	41.3	1.32 (0.87, 1.99)		1.30 (0.88, 1.94)	
	D	436	35.4	1.13 (0.75, 1.70)		1.12 (0.75, 1.67)	
	E (lowest)	51	31.4	1.00		1.00[h]	
	Body mass index				0.01[e]		0.05[e]
3	Chronic energy deficiency	18	61.1	1.66 (1.14, 2.45)		1.67 (1.12, 2.49)	
	Normal	613	36.7	1.00		1.00[i]	
	Overweight	543	40.9	1.11 (0.95, 1.27)		1.03 (0.90, 1.19)	
	Obesity	179	47.8	1.30 (1.11, 1.51)		1.18 (1.00, 1.40)	
	Self-reported health status				0.003[f]		0.009[f]
3	Excellent	166	32.1	1.00		1.00[i]	
	Very good	224	35.9	1.12 (0.81, 1.54)		1.06 (0.78, 1.46)	
	Good	697	41.1	1.28 (0.99, 1.65)		1.28 (0.99, 1.65)	
	Average	258	46.1	1.43 (1.07, 1.92)		1.39 (1.03, 1.89)	
	Poor	24	50.0	1.56 (1.02, 2.37)		1.43 (0.90, 2.26)	
Total	1374		40.2	—	—	—	—

[a] Level in the hierarchical model.
[b] Maximum of 21 missing values (BMI).
[c] Prevalence ratio (PR).
[d] Confidence interval (CI).
[e] Wald test for heterogeneity.
[f] Wald test for trend.
[g] Controlling for level 1 variables.
[h] Controlling for levels 1 and 2 variables.
[i] Controlling for levels 1, 2, and 3 variables.
[j] Classified according to the Brazilian National Association of Research Institutes.

DISCUSSION

To the authors' knowledge, this is the first study to use IPAQ in a population-based sample to investigate the prevalence of inactivity and associated variables. Despite the lack of publications in the formal literature providing adequate evidence for its validity, several reasons can support its utilization in this research: a) the instrument is widely recommended by the scientific literature and by the WHO and CDC; b) it has the potential possibility to provide comparable data on physical activity worldwide; and c) there is a lack of studies evaluating the four components of physical activity, which IPAQ addresses. An unpublished international study in 12 countries showed correlation coefficients between the short and long IPAQ results ranging from 0.28 to 0.78, but use of these parameters for validation has been criticized (6). A small-scale pilot study was carried out in our city concomitant with this investigation, showing that the short version overestimates the prevalence of inactivity.

In addition, numerous other population-based investigations using this questionnaire are being conducted, indicating that soon the present study may potentially be compared with further research addressing the four areas of individuals' physical activity. Furthermore, any limitations of the short IPAQ are more likely to compromise the absolute prevalence value rather than the associations with other variables.

The short version of IPAQ, although addressing the four components of activity, does not allow us to distinguish leisure, occupation, household, or transportation activities, which would be useful for understanding patterns of behavior in developing countries. The importance of this kind of analysis was recently confirmed in a Russian study (26), which concluded that lack of information on transportation physical activities led to a 67% overestimate in the proportion of individuals not sufficiently active to obtain health benefits. To assess this issue, the utilization of the long IPAQ version is recommended.

The initial sample size calculation estimated a design effect of 2.0, but the analysis revealed it to be 4.7. However, as the first sample size calculation required only 1418 individuals and over 3000 were studied, the power remained greater than 90% in the whole sample and greater than 80% in the sex-specific analyses.

TABLE 4. Description of the female sample in terms of demographic, socioeconomic, and behavioral variables, with crude and adjusted prevalence ratios for each independent variable in relation to the outcome (physical inactivity; Pelotas, Brazil, 2002).

Level[a]	Variable[b]	N	% Physical Inactivity	Crude Analysis		Multivariate Analysis	
				PR[c] (CI[d] 95%)	P	PR (CI 95%)	P
	Age (yr)				<0.001[f]		<0.001[f]
1	20–29	385	40.5	1.00		1.00[g]	
	30–39	367	38.5	0.95 (0.79, 1.14)		0.95 (0.79, 1.13)	
	40–49	376	37.3	0.92 (0.75, 1.13)		0.92 (0.77, 1.11)	
	50–59	320	37.3	0.92 (0.76, 1.12)		0.92 (0.76, 1.11)	
	60–69	183	43.2	1.07 (0.85, 1.33)		1.06 (0.86, 1.30)	
	70 or more	177	69.1	1.70 (1.43, 2.03)		1.69 (1.44, 1.98)	
	Skin color				0.06[e]		0.08[e]
1	White	1526	43.0	1.22 (0.99, 1.51)		1.21 (0.98, 1.49)	
	Nonwhite	282	35.1	1.00		1.00[g]	
	Partner status				0.04[e]		0.02[e]
2	With partner	999	39.4	1.00		1.00[h]	
	Without partner	809	44.8	1.14 (1.01, 1.28)		1.15 (1.02, 1.30)	
	Social status[j]				0.03[f]		0.02[f]
2	A (highest)	74	46.6	1.20 (0.81, 1.80)		1.23 (0.83, 1.81)	
	B	337	48.9	1.27 (0.92, 1.74)		1.30 (0.96, 1.77)	
	C	727	40.8	1.05 (0.78, 1.42)		1.08 (0.81, 1.43)	
	D	590	38.7	1.00 (0.72, 1.38)		1.00 (0.73, 1.37)	
	E (lowest)	76	38.7	1.00		1.00[h]	
	Body mass index				0.6[e]		0.9[e]
3	Chronic energy deficiency	65	44.6	1.08 (0.81, 1.43)		1.04 (0.79, 1.38)	
	Normal	846	41.3	1.00		1.00[i]	
	Overweight	525	41.1	1.00 (0.87, 1.13)		0.97 (0.85, 1.11)	
	Obesity	258	43.1	1.04 (0.87, 1.24)		1.01 (0.84, 1.21)	
	Self-reported health status				<0.001[e]		0.01[e]
3	Excellent	134	35.1	1.00	0.3[f]	1.00[i]	0.5[f]
	Very good	256	46.5	1.32 (1.02, 1.72)		1.27 (0.99, 1.64)	
	Good	797	41.3	1.18 (0.94, 1.48)		1.15 (0.92, 1.44)	
	Average	509	38.6	1.10 (0.86, 1.41)		1.05 (0.81, 1.37)	
	Poor	101	58.6	1.67 (1.29, 2.17)		1.51 (1.13, 2.00)	
Total	1808		41.8	—	—	—	—

[a] Level in the hierarchical model.
[b] Maximum of 114 missing values (BMI).
[c] Prevalence ratio (PR).
[d] Confidence interval (CI).
[e] Wald test for heterogeneity.
[f] Wald test for trend.
[g] Controlling for level 1 variables.
[h] Controlling for levels 1 and 2 variables.
[i] Controlling for levels 1, 2, and 3 variables.
[j] Classified according to the Brazilian National Association of Research Institutes.

Among the methodological strengths of the study, the low refusal rate (5.6%) and the similarity between sociodemographic characteristics of our sample and regional census data should be noted. For example, the distribution by social status in our sample (24% in groups A and B, and 36% in groups D and E) is almost identical to whole-country data (26% and 38%, respectively) (2).

The IPAQ working group recommended its application preferentially by telephone or self-administration, and the recommended age range is 18–65 yr (www.ipaq.ki.SE). However, the application of IPAQ by face-to-face interviews is accepted for developing countries. This approach was chosen because of: a) the relatively high percentage of families without telephone in Brazil, b) the illiteracy rate of approximately 5% in our target population, and c) the lower frequency of nonresponse when face-to-face interviews are used in comparison with telephone or self-administered questionnaires. When our analyses were restricted to subjects aged 20–65 yr, the prevalence of inactivity was reduced from 41.1% to 38.0%, and the results of the analyses of determinants were unchanged.

We opted to use Poisson regression models in the multivariate analysis because they express results in terms of relative risks rather than odds ratios, which would overestimate the prevalence ratios because our outcome has a relatively high prevalence (13). However, if logistic regression models are used, the same associated variables are identified (as described in Results).

The prevalence of physical inactivity (41.1%) is substantially lower than has been reported in previous studies of leisure-time activity. In Australia (7) and the United States (20), the prevalences of leisure physical inactivity were 67.7% and 68.0%, respectively. In a representative sample of industrial workers in a southern Brazilian state, Barros and Nahas (3) found a prevalence of leisure physical inactivity of 68.1%. The difference between our study and those reported above can be attributed to the use of different definitions of physical inactivity, because IPAQ evaluates an individual's total amount of activity (total activity), whereas other instruments are restricted to leisure activities only. Particularly in developing countries, occupation and transportation activities represent a substantial proportion of individuals' total activity. An alternative (and in our view, less likely) explanation for this difference might be that over reporting is a concern with IPAQ in comparison with other questionnaires.

Most studies (3,7,18) have shown that men are more active than women in their leisure time, a finding that was not confirmed for total inactivity prevalence in the present study. IPAQ is one of the few instruments to address household activities, which in many cases are largely specific to women. Inclusion of this category of activities is an important factor contributing to the lack of sex differences we observed in the prevalence of total inactivity. In view of this finding, household activities appear important for research aimed at quantifying and comparing activity levels by gender.

The positive association between total inactivity prevalence and age is consistent with the literature (7,8). There is a marked decline in total activity level after 70 yr, which may be attributable to an increasingly sedentary lifestyle being adopted after retirement, which was also observed in the Arteriosclerosis Risk in Communities (ARIC) study (23).

Few studies have explored the relationship between skin color and physical activity behavior (11,18). A recent study in U.S. adolescents (11) found important ethnic differences in the associations between physical activity (low-intensity, moderate, and vigorous activities) or inactivity (television/video viewing, video game/computer use) and overweight. In our study, white skin color was associated with a higher prevalence of inactivity. The fact that adjustment for social status did not change the magnitude of this association suggests that this may represent a true finding rather than an artifact. Qualitative research may help understand this association more clearly.

Several studies (3,18) have shown that leisure physical inactivity is inversely associated with socioeconomic status. In this study, we found a positive linear association between social status and total inactivity prevalence. It is known that individuals of lower socioeconomic status tend to have a greater degree of occupation activity and reduced participation in leisure activities (8). We speculate that this result reflects the likelihood that occupation activities are a more important component of total activity level than leisure activities in developing countries.

Partner status was associated with total activity prevalence only in women, with those living without partners having a higher prevalence of low activity. There are no comparable data in the literature; however, one study (7) found that parents with dependent children had lower activity levels than nonparents, single adults, or parents with no dependent children.

Due to logistical and cost constraints, weight and height were reported by the subject rather than measured, even though previous research in this population found significantly poorer recall accuracy in elderly women of lower socioeconomic status (unpublished data). However, such biases are unlikely to have adversely influenced our findings because between-individual variability in BMI is substantially greater than variability attributable to within-individual error.

Relationships between inactivity and BMI were markedly different according to gender. Whereas among women we found no association between these variables, men with chronic energy deficiency or obesity were more likely to be inactive. The lack of an association among women may be due to two factors: a) a cross-sectional design is not appropriate for studying this association in populations where exercise practice is widely recommended as a treatment for obesity; and b) BMI does not measure fatness itself, and exercise may stimulate muscle growth. The lack of a cross-sectional association between these variables in women, however, does not negate the causative role for physical inactivity in the etiology of obesity, which is fully described in the literature (4,11).

The inverse linear association between total inactivity prevalence and self-reported health status is consistent with an Australian study (7) and indicates that active individuals classify their own health more positively than those who are sedentary.

An Australian (7) study showed a higher prevalence of leisure inactivity among current smokers. This result was not confirmed for total activity in the present study. Equally, we found no significant differences in physical inactivity prevalence according to religious practice.

This is the first Brazilian study, and one of few worldwide, addressing all four components of physical activity in an investigation of the prevalence of inactivity. Our results indicate substantial differences between leisure and total activity levels, in relation both to the prevalence of inactivity and to the variables associated with it. Studies evaluating only leisure activities, particularly in developing countries, are likely systematically to underestimate activity levels of women, individuals from lower socioeconomic status, and potentially other groups associated with poverty, such as smokers.

Extrapolation of these results to other populations has to be carefully considered. Although Brazil is a large country and some regions may have different physical activity patterns, in our view, Pelotas is arguably representative of relatively developed areas of Latin America, undergoing rapid epidemiological and nutritional transitions. Furthermore, it represents a scenario likely to be faced by most parts of our region within the next couple of decades.

To conclude, the prevalence of physical inactivity in this Brazilian adult population is high, even though lower than reported in studies of leisure activity alone in other populations. An improved understanding of the variables associated with inactivity will aid in the search for those factors that predispose to sedentarism. The design of the present study highlights differences between individuals, and one may be tempted to suggest that public health promotions might be more successful if they target particular subsections of the population as opposed to specific behaviors in the whole population. However, there may well be other determinants that affect the population more equally (24) and that would only be detectable by comparing whole communities rather than individuals. Further studies are required to investigate such factors. Furthermore, studies such as ours should be undertaken regularly in order to monitor secular trends in physical activity patterns.

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