

Physical activity in adults from two Brazilian areas: similarities and differences

Nível de atividade física em adultos de duas áreas do Brasil: semelhanças e diferenças

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Abstract

Lack of comparability has been a major limitation in studies on physical activity, due to the utilization of different methodological instruments and inconsistent cut-off points. This study aims to compare the levels of physical activity in adults from two Brazilian areas: (a) São Paulo, the richest State in the country; (b) Pelotas, a medium-sized southern Brazilian city. Both sites used cross-sectional population-based designs, with multiple-stage sampling strategies. Level of physical activity was assessed with the short version of the International Physical Activity Questionnaire. Prevalence of sedentary lifestyle was three times higher in Pelotas than in São Paulo. On the other hand, the proportion of very active subjects was significantly higher in Pelotas. The proportion of insufficiently active individuals (sedentary + irregularly active) was almost identical between the sites. Socioeconomic status was inversely related to level of physical activity in both sites. Among the insufficiently active subjects, those living in São Paulo are at least engaged in a limited amount of activity. On the other hand, among sufficiently active people, those living in Pelotas are more active.

Exercise; Motor Activity; Physical Fitness

Introduction

Physical activity is now a public health priority ^{1,2}. Lack of physical activity increases the risk of several chronic diseases ¹, mental disorders ³ and premature mortality ⁴. Despite the accumulated evidence on its benefits, physical activity levels are declining in the United States ². The percentages of physical inactivity (defined as less than 150 minutes/week of moderate physical activity or 60 minutes/week of vigorous physical activity) during leisure time are above 60.0% in the United States ⁵, Australia ⁶, and England ⁷.

In Brazil, the prevalence of leisure-time physical inactivity, using the same criteria presented above, was 96.7% in a study carried out in the Northeast and Southeast regions ⁸. Taking into account all domains of physical activity (leisure-time, occupational, housework, and transportation), the prevalence of physical inactivity is around 45.0% ^{9,10}.

However, most of the above-mentioned studies used different physical activity measurement techniques, and comparability is thus a concern. In order to minimize this problem, a standardized International Physical Activity Questionnaire (IPAQ) has been proposed ¹¹. Therefore, physical activity researchers now have an excellent opportunity for inter-study comparisons.

The aim of this study was to compare physical activity patterns and associated variables

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in two Brazilian areas (State of São Paulo and city of Pelotas, Rio Grande do Sul). The two studies used comparable methodologies, with the same physical activity measurement instrument (IPAQ).

Materials and methods

São Paulo is the most populous State in Brazil (37,032,403 inhabitants), comprising 645 cities. The State, located in Southeast Brazil, is the most developed in the country in terms of industrial size, economic production, and exports. Most inhabitants (93.0%) live in urban areas. Meanwhile, Pelotas is a medium-size southern Brazilian city with a population of 320,000, in Rio Grande do Sul State. This is a relatively affluent area of Brazil, near Uruguay and Argentina. The main economic activities are agriculture, commerce, and education (the city is home to two large universities)¹². Table 1 summarizes similarities and differences between Pelotas (city) and São Paulo (State).

Both sites used cross-sectional population-based designs. In São Paulo, the age-range was 15 to 96 years while in Pelotas it was 20 to 98 years. This analysis was restricted to adults aged 20-69 years from both sites. Multiple-stage sampling procedures were undertaken in both sites to obtain representative samples of households. Details of both sampling strategies are described elsewhere^{9,10}. In brief, the census tracts defined by the Brazilian Institute of Geography and Statistics (IBGE) were the primary sample units (PSU) in Pelotas, and the secondary sample units in São Paulo; the cities were the PSUs in São Paulo. Systematic sampling schemes were undertaken to sample households in each selected census tract. The São Paulo sample included 29 cities: São Paulo, Santo André, São

Bernardo do Campo, Guarulhos, Osasco, São José dos Campos, Taubaté, Pindamonhangaba, Santos, São Vicente, Praia Grande, Ilabela, São Sebastião, Campinas, Piracicaba, Sorocaba, Limeira, Rio Claro, Santa Barbara do Oeste, São José do Rio Preto, Barretos, Ribeirão Preto, Franca, Presidente Prudente, Araçatuba, Bauru, Araraquara, Marília, and São Carlos. The Pelotas data collection was carried out in the first semester of 2002 (February-May), while data in São Paulo were collected in July of the same year. This small interval between studies guarantees that temporal trends in physical activity do not affect our comparisons¹³.

Previous sample size calculations were carried out in both sites in order to meet other specific objectives. These calculations have also been described elsewhere^{9,10}. For this analysis, the power and precision of the comparisons were calculated. Power to detect differences in proportions of insufficient activity was greater than 80.0% for a difference of two percentage points. Other calculations required smaller sample sizes and are thus not presented here.

The short, 8th, previous week's version of the IPAQ was applied by face-to-face interviews in each site. IPAQ differentiates between moderate and vigorous activities; moderate activities are those that produce a moderate increase in heart rate and respiratory rate, while vigorous activities are those that produce major increases in the same variables. IPAQ takes into account walking and moderate and vigorous activities performed for at least ten consecutive minutes¹¹. The validity and reliability of the IPAQ questionnaire are presented in the discussion section.

Weekly time spent in both moderate and vigorous activities was separately calculated (walking was included as a moderate physical activity). Several simulations of inactivity prevalence based on current physical activity guidelines^{1,14} were carried out: (a) at least 150 minutes/week of moderate physical activity performed at least five days; (b) at least 150 minutes/week regardless of weekly frequency; (c) at least 60 minutes/week of vigorous physical activity performed at least three days; (d) at least 60 minutes/week of vigorous physical activity regardless of weekly frequency; and (e) compliance with items "b" and "d".

A score was later created as the weekly time spent in moderate activities (including rapid and moderately rapid walking), plus twice the time spent in vigorous activities¹⁰. Individuals were categorized into four groups according to the physical activity score: (a) sedentary: score zero minutes/week; (b) irregularly active: score

Table 1

Comparison of health-related and economic indicators between the city of Pelotas and São Paulo State, Brazil, 2003.

Variable*	Pelotas	São Paulo State
Gini index (income inequality)	0.60	0.58
Inhabitants	320,000	37,000,000
Inhabitants per physician	260	447
Life expectancy	73**	71
Infant mortality rate	20.0/1,000	18.6/1,000

* Source: Brazilian Institute of Geography and Statistics¹³;

** Data for the State of Rio Grande do Sul, Brazil.

between 1-149 minutes/week; (c) regularly active: score between 150-999 minutes/week; and (d) very active: score \geq 1000 minutes/week. For some specific analyses, the sample was categorized only into two groups: (a) insufficiently active (sedentary + irregularly active); and (b) sufficiently active (regularly active + very active).

Each separate site has addressed several independent variables. In São Paulo, sex, age, socioeconomic status, geographic distribution, and knowledge concerning physical activity were investigated. In Pelotas, sex, age, skin color, schooling, socioeconomic status, body mass index, marital status, smoking, self-reported health status, and religion practice were evaluated. Our analysis used the three independent variables available for both sites (sex, age, and socioeconomic status). Classification of socioeconomic status takes into account both household assets and education of the head of the family and is categorized into five groups (A to E), with A as the wealthiest¹⁵.

Confidentiality of individual data was guaranteed in both studies. The Research Ethics Committee of the Pelotas Federal University School of Medicine approved the Pelotas study, while the São Paulo study was approved by the Ethics Committee of the Physical Fitness Research Center from São Caetano do Sul.

Results

Table 2 provides a description of both samples. The São Paulo sample was slightly more homogeneous in terms of gender. Restricting both samples to adults (20-69 years, as described above), the average ages were 40.9 (SD = 13.4) and 38.9 (SD = 13.0) years in Pelotas and São Paulo, respectively. The Pelotas sample showed a lower mean income, with more people in the E class and less in the A group. In Brazil as a whole, 5.0% of the population belong to the A class and 12.0% to the E class¹⁵.

Table 3 shows detailed data on physical activity patterns in both sites. Median physical activity score was significantly higher in Pelotas. The proportion of individuals who did not report any moderate activity in the week prior to the interview was higher in Pelotas, while the equivalent proportion for vigorous activities was higher in São Paulo. The frequencies of both sedentary lifestyle and high activity level were higher in Pelotas. The Pelotas sample presented a higher proportion of compliance with all interpretations of the guidelines. However, the percentage of individuals with scores below 150 was almost identical ($p = 0.77$) in both sites

Table 2

Description of the Pelotas and São Paulo samples in terms of gender, age, and socioeconomic status. Brazil, 2003.

Variable	Pelotas		São Paulo	
	n	%	n	%
Gender				
Male	1,275	43.9	1,114	47.4
Female	1,631	56.1	1,234	52.6
Age (years)				
20-29	719	24.7	709	30.2
30-39	680	23.4	622	26.5
40-49	667	23.0	494	21.0
50-59	533	18.3	319	13.6
60-69	307	10.6	204	8.7
Socioeconomic status*				
A (wealthiest)	141	4.9	192	8.2
B	554	19.1	778	33.1
C	1,168	40.3	922	39.3
D	920	31.8	430	18.3
E	112	3.9	26	1.1

* According to the classification of the National Association of Opinion Polls (Associação Nacional de Empresas de Pesquisa)¹⁵.

(39.0% and 39.4% in Pelotas and São Paulo, respectively).

Table 4 shows the relationship between sedentary lifestyle and the independent variables stratified by site. Sedentary lifestyle was more common among men in São Paulo, but no differences were found in Pelotas. Age was positively related to sedentary lifestyle in Pelotas, but not in São Paulo. Sedentary lifestyle was directly related to socioeconomic status in both sites. The highest prevalence of sedentary lifestyle was observed in the wealthiest socioeconomic group (A) in both sites.

Correlates of high activity are shown in Table 5. The prevalence was higher in men in São Paulo, but no gender differences were found in Pelotas. Individuals of the extreme age groups were less likely to be very active in Pelotas, but no differences were found in São Paulo. Individuals from the wealthiest socioeconomic group (A) were less likely to present high activity in Pelotas.

Discussion

Lack of comparability has been a major limitation in studies on physical activity, due to the use of different methodological instruments

Table 3

Comparison of physical activity patterns in Pelotas and São Paulo State, Brazil, 2003.

Parameter	Pelotas	São Paulo State	p-value
Median physical activity score (minutes/week)	260	195	< 0.001*
No moderate physical activity previous week	46.1%	37.7%	< 0.001**
No vigorous physical activity previous week	63.8%	72.1%	< 0.001**
Physical activity categories			
Sedentary (0 minutes/week)	24.8%	8.9%	< 0.001**
Irregularly active (1-149 minutes/week)	14.2%	30.5%	< 0.001**
Regularly active (150-999 minutes/week)	37.3%	54.2%	< 0.001**
Very active (\geq 1000 minutes/week)	23.7%	6.4%	< 0.001**
Meeting moderate physical activity guidelines 1***	26.8%	9.9%	< 0.001**
Meeting moderate physical activity guidelines 2#	35.3%	14.7%	< 0.001**
Meeting vigorous physical activity guidelines 1##	18.7%	12.1%	< 0.001**
Meeting vigorous physical activity guidelines 2###	27.0%	22.0%	< 0.001**
Meeting both guidelines§	12.4%	4.6%	< 0.001**

* Non-parametric K sample test to compare medians; ** Chi-square test to compare proportions; *** At least 150 minutes/week (at least five days/week); # At least 150 minutes/week regardless of weekly frequency; ## At least 60 minutes/week (at least three days/week); ### At least 60 minutes/week regardless of weekly frequency; § More than 150 minutes/week of moderate and 60 minutes/week of vigorous physical activity.

Table 4

Variables associated with sedentary lifestyle in adults from Pelotas and São Paulo State, Brazil, 2003.

Variable	Pelotas				São Paulo State			
	% sedentary lifestyle	PR	95%CI	p-value	% sedentary lifestyle	PR	95%CI	p-value
Gender				0.53**				0.01**
Male	24.1	1.00	–		10.4	1.00	–	
Female	25.4	1.05	0.90-1.23		7.5	0.72	0.55-0.93	
Age (years)				0.001***				0.54***
20-29	20.7	1.00	–		7.3	1.00	–	
30-39	24.4	1.18	0.98-1.42		10.5	1.42	1.01-2.02	
40-49	25.0	1.21	0.96-1.51		9.1	1.24	0.85-1.82	
50-59	28.1	1.36	1.11-1.67		9.1	1.24	0.80-1.91	
60-69	29.3	1.41	1.12-1.79		8.3	1.14	0.67-1.92	
Socioeconomic status*				0.008***				0.02***
A (wealthiest)	33.6	1.00	–		12.0	1.00	–	
B	29.2	0.87	0.65-1.15		9.8	0.82	0.53-1.27	
C	25.0	0.75	0.57-0.98		8.1	0.68	0.44-1.06	
D	20.6	0.61	0.44-0.85		7.9	0.66	0.40-1.09	
E	24.3	0.72	0.45-1.16		0.0	Non-calculable		

PR = prevalence ratio; CI: confidence interval; * Classification by the National Association of Opinion Polls (Associação Nacional de Empresas de Pesquisa) ¹⁵, which considers both household assets and paternal education; ** Wald test for heterogeneity; *** Wald test for trend.

Table 5

Variables associated with high activity level (HAL) in adults from Pelotas and São Paulo State, Brazil, 2003.

Variable	Pelotas				São Paulo State			
	% HAL	PR	95%CI	p-value	% HAL	PR	95%CI	p-value
Gender				0.40**				< 0.001**
Male	24.6	1.07	0.92-1.24		9.3	2.48	1.77-3.48	
Female	23.1	1.00			3.7	1.00		
Age (years)				0.001**				0.31**
20-29	19.0	1.00			6.6	1.00		
30-39	27.4	1.44	1.16-1.79		6.1	0.92	0.61-1.39	
40-49	26.3	1.38	1.10-1.74		7.9	1.19	0.79-1.79	
50-59	24.1	1.27	1.01-1.60		5.0	0.76	0.44-1.31	
60-69	20.2	1.06	0.81-1.39		4.4	0.67	0.33-1.33	
Socioeconomic status*				< 0.001***				0.56***
A (wealthiest)	12.9	1.00			3.7	1.00		
B	14.5	1.13	0.64-2.00		7.6	2.08	0.97-4.48	
C	22.6	1.76	1.04-2.97		5.4	1.49	0.68-3.23	
D	31.7	2.46	1.48-4.11		7.0	1.91	0.86-4.28	
E	28.8	2.24	1.28-3.92		11.5	3.16	0.87-11.49	

PR = prevalence ratio; CI: confidence interval; * Classification by the National Association of Opinion Polls (Associação Nacional de Empresas de Pesquisa) ¹⁵, which considers both household assets and paternal education; ** Wald test for heterogeneity; *** Wald test for trend.

and cut-off points ¹⁶. An international group including Brazil (represented by the Physical Fitness Research Center from São Caetano do Sul) has therefore proposed a standardized questionnaire to address physical activity worldwide. A long version (31 questions) and a shorter one (9 questions) were created ¹¹.

Validity of the IPAQ was tested in several settings, including Brazil. A multi-center study ¹¹ concluded that: (a) the short and long versions provided comparable results; (b) the reliability of both versions was good; and (c) the validity of both versions was comparable to most other self-reported questionnaires, using accelerometers as the gold standard. However, the statistical analysis of this study was criticized recently, particularly in terms of the comparison between the short and long versions ¹⁷. A Brazilian study ¹⁸ presented results comparable to the multi-center research, while another Brazilian study showed that the short and long IPAQ versions do not provide comparable results ¹⁹.

The IPAQ method presents numerous advantages: (a) it addresses the four components of physical activity (leisure-time, housework, occupational, and transportation), while most instruments evaluate only leisure-time physical activity; (b) it is culturally adaptable, with

changes in the examples of activities to pinpoint the population's specificities; (c) it potentially provides a score in minutes per week, which is compatible with public health recommendations for physical activity ^{1,14}; and (d) it allows comparability among studies.

Considering its advantages and limitations, we opted to use the IPAQ questionnaire, particularly in order to allow comparisons with other cities, States, or countries.

The issue can be raised about comparison between a middle-sized city and the wealthiest State in the country. However, as Table 1 shows, there are no extreme differences between the two places in terms of socioeconomic and health-related indicators. Furthermore, comparison between Pelotas and only one city in the São Paulo State would be problematic because the sample size of each city in São Paulo is much smaller than the sample size in Pelotas.

The proportion of insufficiently active subjects (sedentary + irregularly active) was almost identical between Pelotas, a medium-sized city, and São Paulo, the wealthiest State in Brazil. However, important differences were noted. Prevalence of sedentary lifestyle was approximately three times higher in Pelotas than in São Paulo. This result might reflect the likelihood that the São Paulo population is attempt-

ing to change to a less sedentary lifestyle, even when the intensity or frequency of physical activity is below the minimum recommended level for obtain health benefits. One explanation could be the exercise promotion program known as “*Agita São Paulo*”, launched in December 1996²⁰ and known to 39.1% of the entire State population. In the long term the São Paulo sample may more readily achieve current physical activity guidelines, because its baseline activity is higher. It is important to highlight that no such programs are available in Pelotas. Other factors such as media exposure and availability of fitness areas may also explain the observed differences.

On the other hand, the proportion of very active individuals was higher in Pelotas. In our view, greater physical activity at work¹⁰ may explain this result, because the physical activity score required to be classified as very active is difficult to achieve only with leisure-time physical activity. Over-reporting of the IPAQ method could be another explanation²¹, but due to the fact that the methodologies used in both sites were comparable, this hypothesis seems unlikely.

Correlates of sedentary lifestyle and high activity were intriguing. While men were more sedentary than women in São Paulo, no such trend was observed in Pelotas. However, a positive association between age and sedentary lifestyle was found only in Pelotas. Socioeconomic status was directly related to sedentary lifestyle in both sites. Male gender was associated with high activity only in São Paulo, while age was related to high activity only in Pelotas, with higher frequencies in the central groups. Socioeconomic status was inversely associated with high activity in both sites, although the São Paulo results showed only borderline significance.

Gender differences in physical activity have been studied exhaustively. During leisure time, men are clearly more active than women^{6,8,22}. However, the prevalence of physical inactivity taking into account all components of physical activity is similar between men and women^{9,10}. Inclusion of household chores is the most obvious explanation. Our study adds to the current knowledge by showing that high physical activity is more frequent among men, probably due to more activity at work outside the household and participation in competitive sports.

An age-related decline in leisure-time physical activity is described in detail in the literature^{6,23}. However, evaluation of total physical activity¹⁰ has shown a stable prevalence up to 60 years of age, followed by a marked increase in

the prevalence of physical inactivity. Retirement has been proposed as a possible explanation²⁴. Our results showed lower frequencies of sedentary lifestyle in the 20-29-year bracket and higher prevalence of high activity in the intermediate bracket (30-59 years). However, these results were less clear in São Paulo than in Pelotas.

Socioeconomic status is differentially related to leisure-time and total physical activity. While physical activity during leisure time is positively related to socioeconomic status^{22,25}, an inverse trend is observed in relation to total physical activity¹⁰. This study showed consistently lower activity levels among individuals from the wealthiest socioeconomic group.

Socioeconomic differences in physical activity should be interpreted with caution. Since IPAQ evaluates all domains of activity, total physical activity is greater among poor people, probably because they are more engaged in moderate to vigorous jobs. On the other hand, leisure-time physical activity, which is more a choice than an obligation, is more frequent among the rich. This relationship agrees with the “diffusion of innovations theory”²⁶, which states that new resources (in this case, encouragement for physical activity) initially accrue to the wealthy. The association between all physical activity domains and socioeconomic status requires further investigation.

Regardless of the interpretation of current physical activity guidelines^{1,14}, low physical activity is widespread in both Pelotas and São Paulo. Therefore, strategies to foster physical activity in the community are still needed. Both improved knowledge of the benefits deriving from physical activity⁹ and environmental strategies²⁷ have been shown to be effective to increase physical activity in communities. In our view, a combination of individual strategies (such as counseling campaigns) and environmental improvements (such as green areas and public safety improvements) are ideal to increase physical activity in the population.

The prevalence of physical inactivity in our studies was markedly lower than reported in studies of leisure-time physical activity alone⁸. Correlates of inactivity are also slightly different from leisure-time studies^{5,6,8}. The areas compared (São Paulo State and Pelotas city) were quite similar in terms of the prevalence of physical inactivity, although the prevalence of sedentary lifestyle was clearly higher in Pelotas. Correlates of sedentary lifestyle and high activity level were mainly consistent between the two areas.

Resumo

A incomparabilidade sempre foi uma limitação entre os estudos sobre atividade física, em função da utilização de vários instrumentos e pontos de corte inconsistentes. Comparou-se o nível de atividade física de adultos do Estado de São Paulo e da cidade de Pelotas, Rio Grande do Sul, no Brasil. Ambos os centros usaram delineamento transversal de base populacional, com amostragem em múltiplos estágios. A prática de atividade física foi avaliada com a versão curta do Questionário Internacional de Atividade Física. A prevalência de sedentarismo foi três vezes maior em Pelotas do que em São Paulo. Já a proporção de pessoas muito ativas foi significativamente maior em Pelotas. A prevalência de atividade física insuficiente (sedentários + irregularmente ativos) foi similar em ambos os centros. O nível sócio-econômico associou-se inversamente com o nível de atividade física nos dois centros. Entre as pessoas insuficientemente ativas, as de São Paulo estão ao menos praticando uma pequena quantidade de atividade física. Já entre os suficientemente ativos, as pessoas de Pelotas têm maior nível de atividade física.

Exercício; Atividade Motora; Aptidão Física

Contributors

P. C. Hallal and A. D. Bertoldi coordinated the research in Pelotas, Rio Grande do Sul, Brazil. S. M. Matsudo, V. K. R. Matsudo, T. L. Araújo, and D. R. Andrade coordinated the research in São Paulo, Brazil. The analyses were coordinated by P. C. Hallal and S. M. Matsudo. A. D. Bertoldi and V. K. R. Matsudo headed the drafting of the article. All the authors reviewed the initial drafts of the article and collaborated in the analysis.

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