Differences and similarities in stages of behavioral change related to physical activity in adolescents from two regions of Brazil

Diferenças e similaridades dos estágios de mudança de comportamento para atividade física em adolescentes de duas áreas brasileiras

Diferencias y similitudes de las etapas de cambio de comportamiento para actividad física en adolescentes de dos áreas brasileñas

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ABSTRACT

Objective: To establish differences and similarities in stages of behavioral change related to physical activity and associated factors in adolescents from two regions of Brazil.

Methods: A cross-sectional study was conducted on public school students aged 14 to 17 years, including 601 from the mid-west of Santa Catarina (SC, Brazil) and 464 from the north of Minas Gerais (MG, Brazil). Stages of behavioral change related to physical activity were identified using a standard questionnaire. Sociodemographic data, body adiposity indexes and nutritional status were collected. The following were used for data analysis: chi-square test, Fisher's exact test, comparison of proportions and multivariable analysis using Poisson regression with a robust variance, being significant $p \leq 0.05$.

Results: Most students from Minas Gerais and Santa Catarina were in the preparation (32.8%) and maintenance (41.9%) stages. In both regions, adolescent girls presented a higher probability of a physically inactive behavior (SC: PR=1.25; 95%CI 1.04-1.50; MG: PR=1.53; 95%CI 1.29-1.80). Other risk groups were low weight adolescents from Santa Catarina (PR=1.39; 95%CI 1.06-1.81) and adolescents with excess body adiposity from Minas Gerais (PR=1.21; 95%CI 1.02-1.49).

Conclusions: Interventions to promote physical activity that consider the cultural and economic characteristics of each locality are recommended.

Key-words: motor activity; adolescent; students; cross-sectional studies

RESUMO

Objetivo: Determinar as diferenças e similaridades dos estágios de mudança de comportamento para atividade física e fatores associados em adolescentes de duas áreas brasileiras.

Métodos: Estudo transversal conduzido em escolares de 14 a 17 anos, de escolas públicas, sendo 601 do Meio Oeste Catarinense (SC) e 464 do Norte de Minas (MG). Identificaram-se os estágios de mudança de comportamento para atividade física por meio de questionário padronizado.

Coletaram-se informações sociodemográficas, dados de adiposidade corporal e estado nutricional. Foram empregados o teste do qui-quadrado ou exato de Fisher ou teste de comparação entre duas proporções e a regressão multivariável de Poisson com variância robusta, adotando-se nível de significância de 5%.

Resultados: A maior parte dos estudantes de Minas Gerais e de Santa Catarina encontrava-se no estágio preparação (32,8%) e manutenção (41,9%). Em ambas as regiões, o sexo feminino apresentou maior probabilidade de ter um comportamento inativo fisicamente (SC: RP=1,25; IC95% 1,04-1,50; MG: RP=1,53; IC95% 1,29-1,80). Outros grupos de risco foram sujeitos com baixo peso em Santa Catarina (RP=1,39; IC95% 1,06-1,81) e com excesso de adiposidade em Minas Gerais (RP=1,21; IC95% 1,02-1,49).

Conclusões: Intervenções de promoção da atividade física que considerem características culturais e econômicas para cada localidade são recomendadas.

Palavras-chaves: atividade motora; adolescente; estudantes; estudos transversais

RESUMEN

Objetivo: Determinar las diferencias y similitudes de las Etapas de Cambio de Comportamiento (ECC) para Actividad Física (AF) y factores asociados en adolescentes de dos áreas brasileñas.

Métodos: Estudio transversal conducido en escolares de 14 a 17 años, de escuelas públicas, siendo 601 del Medio Oeste Catarinense, SC, Brasil, y 464 del Norte de Minas, MG, Brasil. Se identificaron los ECC para AF mediante cuestionario estandarizado. Se recogieron informaciones socio demográficas, datos de adiposidad corporal y estado nutricional. Se empleó la prueba de chi cuadrado o el Exacto de Fisher o prueba de comparación entre dos proporciones y la regresión multivariable de Poisson con variancia robusta, adoptando el nivel de significancia de 5%.

Resultados: La mayor parte de los estudiantes de MG y SC estaban en las etapas de preparación (32,8%) y mantenimiento (41,9%). En ambas regiones, el sexo femenino presentó mayor probabilidad de tener un comportamiento inactivo físicamente (SC: RP=1,25; IC95% 1,04-1,50; MG: RP=1,53; IC95% 1,29-1,80). Otros grupos de riesgo fueron sujetos con bajo peso en SC (RP=1,39; IC95% 1,06-1,81) y con exceso de adiposidad en MG (RP=1,21; IC95% 1,02-1,49).

Conclusiones: Intervenciones de promoción de AF que tengan en cuenta características culturales y económicas para cada localidad son recomendadas.

Palabras clave: actividad motora; adolescentes; estudiantes; estudios transversales.

Introduction

The transtheoretical model is one of the most widely utilized for the planning of health promotion strategies, because it is able to identify five different stages (precontemplation, contemplation, preparation, action and maintenance) that follow a sequence from "less healthy" to "more healthy". This model has been applied to many health behaviors since the 1980s, and makes it possible to distinguish between individuals who are inclined to make changes to their behavior from those who do not intend to change[1].

The behavior change model has been widely used to treat users of tobacco[2] and illicit drugs[3], to prevent pregnancy[4] and to modify dietary habits[5]. In the 1990s it began to be used to encourage physical activity (PA)[6], primarily because of publications providing evidence of the benefits of an active lifestyle.

Identification of the Behavior Change Stages (BCS) for PA can be considered one of the initial steps in developing intervention strategies, since each behavior identified will be targeted with specific efforts[6]. Studies have demonstrated success using this model as a basis for policies to promote PA in the community[7] and health services[8] and can be used as examples for further interventions.

Brazil is a country of continental dimensions and the customs, income distribution and accumulation of wealth all differ from one region to another. These differences translate to different lifestyle habits which, in turn, are reflected in health behaviors. Siqueira *et al*[9] investigated the patterns of physical activity among health professionals working in primary care in the South and Northeast regions of Brazil and found that the prevalence of inactivity in Paraíba was 33.4% and that in Santa Catarina it was 25.3%. Another study analyzed physical activity patterns and dietary habits among young people in secondary education in the city of Recife, PE and also in Florianópolis, SC and found that the prevalence of inactivity was higher in the Northeast (12.3%) than in the South (9.2%) and that schoolchildren from the Northeast ate more fruit than those from the South[10].

In response to the possibility that BCS can indicate a range of distinct strategies to encourage young people to be more physically active, the objective of this study is to determine the differences and similarities between adolescents from the Midwest of Santa Catarina state and from the mid São Francisco region in the North of Minas Gerais state, in terms of physical activity behavioral change steps (PA-BCS) and the factors associated with them.

Methods

The Midwest of Santa Catarina is one of the mesoregions of this Brazilian state[11]. It has an area of 9,136 km² and a Human Development Index (HDI) of 0.807[12]. Five of the twenty top-ranked municipalities for quality of life in Brazil are in this region. The area's principal economic activities are industry, commerce and tourism. The most important town is Joaçaba, which is considered an economic and political pole within the Midwest of Santa Catarina and which has an estimated population of 25,322 inhabitants[11].

The North of Minas is a mesoregion in the Brazilian state of Minas Gerais[11]. It has a total area of 33,169 km² and its HDI is 0.655[12]. The region's economy is predominantly primary and farming and agricultural products are the most important sectors. The most important town in the region, Januária, is responsible for the greater part of the economy, is where the largest higher education institutions are located and has an estimated population of 67,516 inhabitants[11].

This cross-sectional study recruited schoolchildren aged 14 to 17 enrolled at state-run public schools during the second semester of 2008 in both regions. The study was approved by Human Research Ethics Committees at the *Universidade do Oeste de Santa Catarina* and at the *Faculdades Unidas do Norte de Minas*.

A two-stage sampling process was used in the Midwest of Santa Catarina, stratified by public secondary schools and then clustered by classes. In the first stage, only schools with more than 150 pupils enrolled were selected and the school with the largest number of pupils was chosen in towns with more than one institution. In the second stage, all adolescents present in class on the day of data collection were invited to take part.

The sampling process used in the North of Minas Gerais was stratified by primary and secondary public schools and clustered by classes. In the first stage, only those schools in the town of Januária, MG, that offered both primary and secondary education were selected, because these were the largest schools in the region and were where the largest numbers of pupils were concentrated. Schools were chosen to take part by lots from a list provided by the institutions themselves that included the ages of their students. In the second stage, all adolescents aged 14 to 17 who were present in class were invited to take part in the study.

Several different sample size calculations were performed for both samples since each were part of different research projects measuring different outcomes. The sample used in the analysis described here was selected for a study on the prevalence of physical inactivity. The assumptions for sample size calculations were as follows: 70% outcome prevalence[13], acceptable error of five percentage points, 95% confidence level, design effect of 1.5 and 10% added for losses to the sample/refusals.

On the basis of a total of 4,582 pupils enrolled in secondary education in the Midwest of Santa Catarina, the estimated sample size was 498 adolescents. In the North of Minas Gerais, there were 4,495 children enrolled at primary and secondary public schools and, as a result, the sample size was estimated at 458 pupils. Since the sample process specified including every member of each cluster, the actual sample sizes were 601 adolescents in the Midwest of Santa Catarina and 569 in the North of Minas Gerais.

The eligibility criteria for this investigation were enrollment in the state education system, presence in the classroom on data collection day and age 14 to 17 years. The exclusion criteria were (a) age less than 14 or greater than 17; (b) failure to provide a free and informed consent form signed by a parent or guardian; (c) refusal to take part; (d) failure to complete the questionnaire.

Fieldwork was conducted by a different team in each region. Each team included professors and students from the physical education department who had been duly trained to conduct all procedures necessary in such a way as to standardize data collection. The schoolchildren were told about the assessments at least 5 days in advance, when they were given the free and informed consent forms and the procedures involved were explained to them.

The PA-BCS were investigated using a questionnaire[6] that classifies respondents at one of five stages: (1) Precontemplation (respondents who do not intend to modify their behavior in the near future); (2) Contemplation (there is an intention to change, but not immediately); (3) Preparation (respondents who are not engaged in regular PA, but who intend to begin within 30 days); 4 - Action (respondents whole have been regularly active for less than 6 months); 5

- Maintenance (regularly active for a minimum of 6 months). On the basis of the BCS results, the schoolchildren were classified as having "inactive" behavior, for stages 1, 2 and 3, or "active" behavior, if in stages 4 or 5. Evidence on the efficacy, sensitivity and specificity of this classification is available in the literature[14].

Physical Activity was defined as any bodily movement produced by skeletal musculature that results in energy expenditure greater than the at-rest expenditure[15]. Physical activity is not therefore restricted to activities supervised by Physical Education professionals. For the purposes of the PA-BCS instrument, a healthy level of PA was defined in line with the recommendation for adolescents, which state that they should participate in PA of at least moderate intensity for at least 60 minutes per day[16].

The students' economic status was identified using a questionnaire developed by the Brazilian Association of Market Research Companies (ABEP - *Associação Brasileira de Empresas de Pesquisa*)[17] which divides the Brazilian population into five economic classes in decreasing order of purchasing power ("A", "B", "C", "D" and "E"). For this study, categories "A" + "B" were collapsed and called high status; "C" was defined as medium status and "D" + "E" were taken together and termed low economic status. A preliminary distribution of the frequencies showed that in the Midwest of Santa Catarina 66.4% of the schoolchildren had high economic status, 32.6% medium and 1.0% low. In the North of Minas, there were 0.2% with a high economic status, 2.4% medium and 97.4% low. The low number of low economic status students in Santa Catarina and of high status students in Minas Gerais made a Poisson regression analysis impossible, because the Hessian matrix was singular, and so one of the assumptions could not be met. For this reason, the medium and low categories were collapsed for Santa Catarina and the medium and high categories were combined for the North of Minas.

Anthropometric variables (body mass, height and tricipital and subscapular skin fold thicknesses) were measured using standardized procedures[18]. Body mass indexes were calculated and classified according to cutoff points for adolescents, which vary by age and sex[19,20]. The adolescents were classified as underweight, normal weight or overweight (overweight + obesity), according to recommendations made by Cole *et al*[19,20]. Body adiposity was determined using Σ2SF (triceps + subscapular skinfolds), classified according to the literature[21]: low (Σ2SF <13mm or <12mm), normal (Σ2SF from 13 to 36mm or 12 to 25mm) or elevated (Σ2SF >36mm or >25mm), for females and males respectively. A preliminary consideration of the distribution showed that few adolescents were in the low Σ2SF group, so this category was combined with normal Σ2SF.

The chi-square test or Fisher's exact test for comparisons between two proportions were used to test for possible differences in frequency between variables. Since it was observed that the dependent variable (inactive behavior) had an elevated prevalence, Poisson regression robust variance estimation was used to investigate the outcome's associations with the exploratory variables, estimating prevalence ratios and confidence intervals. All of the variables under investigation were then included in a multivariate regression model. The significance level was set at 5%.

Results

None of the schoolchildren in either region refused to take part in the studies. In the North of Minas, MG, 105 schoolchildren were excluded because they had not completed the questionnaire. The sample from the Midwest of Santa Catarina contained 601 secondary school pupils, with a mean age of 15.7±1.1 years and the sample from the North of Minas included 464 adolescents aged 15.4±1.1.

Differences between the regions were detected in terms of economic status, age, Σ2DC and nutritional status. The students from Santa Catarina had a high economic status, were in the 16-17 age group, had elevated body adiposity and were overweight, compared to those from the North of Minas (Table 1).

Figure 1 illustrates the distribution of PA-BCS among the adolescents from both regions. The category with the largest proportion of children from the North of Minas Gerais was the preparation stage. In contrast, the largest proportion of the pupils from the Midwest of Santa Catarina were in the maintenance stage. There were more children at the contemplation stage in the North of Minas Gerais than in Santa Catarina. In turn, more children in Santa Catarina were at the maintenance stage, when compared with Minas Gerais (*p*≤0.05). In the Midwest of Santa Catarina, 44.1% of the children investigated were classified at stages indicating physically inactive behavior and, 55.9% were classified at stages indicating regular active behavior. In the North of Minas Gerais, 60.1% were at physically inactive behavior stages while 39.9% were active (Figure 1).

Table 2 lists the raw and adjusted effects of possible risk factors for physically inactive behavior for the children from the Midwest of Santa Catarina and Table 3 provides the same data for the children from MG.

Table 1 - Demographic and socioeconomic characteristics, body adiposity and nutritional status of schoolchildren from the Midwest of Santa Catarina and the North of Minas Gerais (Brazil)

	Midwest of Santa Catarina, SC		North of Minas, MG		p-value
	n	(%)	n	(%)	
Sex					
Male	269	57.7	197	42.3	0.453
Female	332	55.4	267	44.6	
Economic status					
A+B	339	99.8	1	0.3	<0.001[†]
C	196	94.7	11	5.3	
D+E	6	1.3	452	98.7	
Age					
14-15 years	246	49.0	256	51.0	<0.001*
16-17 years	355	63.1	208	36.9	
∑ 2SF					
Normal	427	51.6	400	48.4	<0.001*
Elevated	174	73.1	64	26.9	
Nutritional status					
Underweight	48	40.0	72	60.0	<0.001*
Normal weight	475	57.9	345	42.1	
Overweight	78	62.4	47	37.6	

∑2SF – sum of two skin fold thicknesses (triceps + subscapular); *$p \leq 0.05$ (Chi-square test); [†]$p \leq 0.05$ (Fisher's exact test).
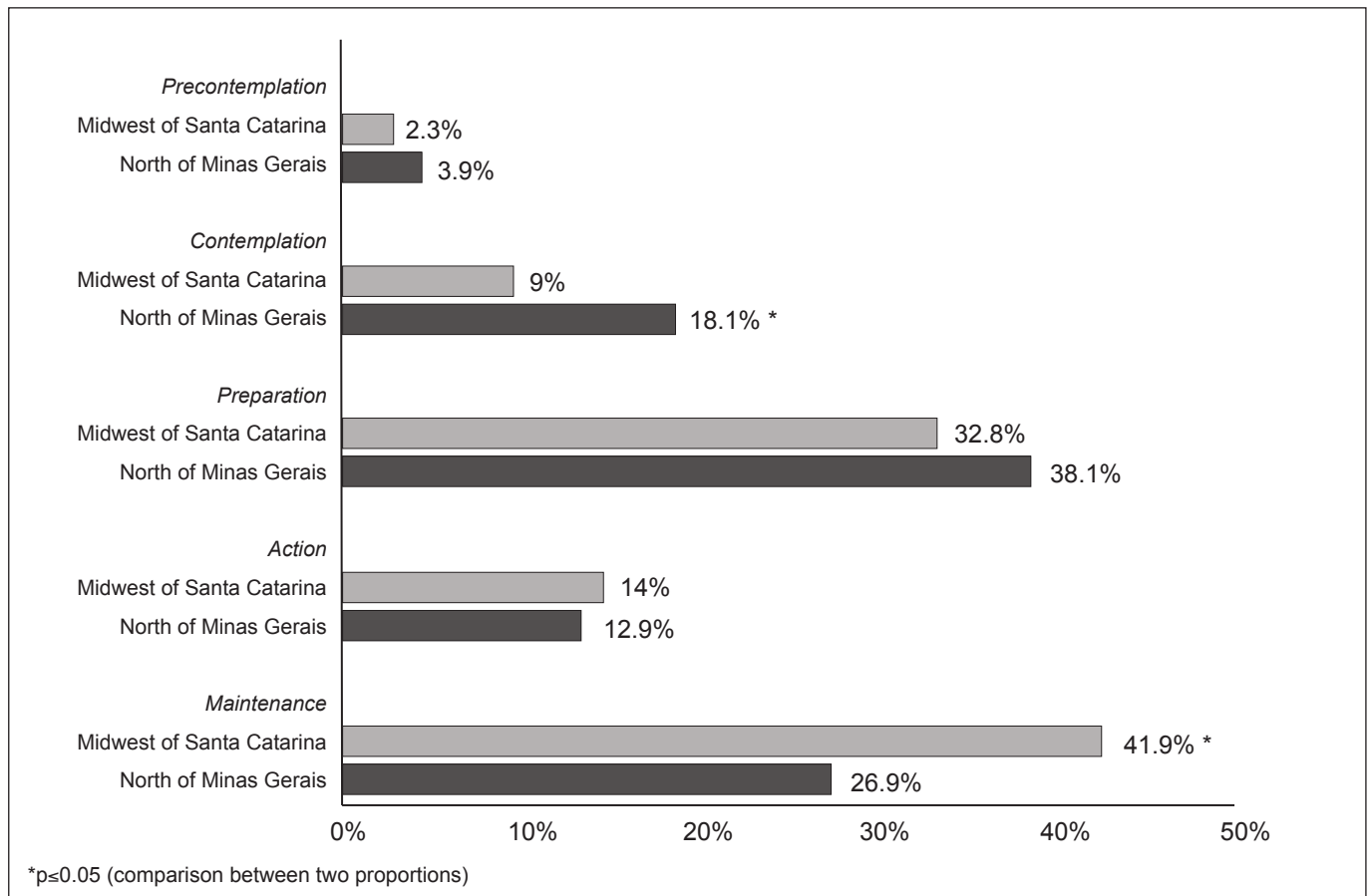

Figure 1 - Distribution of the schoolchildren by PA-BCS. Midwest of Santa Catarina, SC and North of Minas, MG. 2008

Table 2 - Crude and adjusted prevalence ratios for a physically inactive behavior stage, by sociodemographic characteristics, body adiposity and nutritional status of schoolchildren from the Midwest of Santa Catarina, SC (n=601)

	BCS					
	Crude analysis			Adjusted analysis		
	PR	95%CI	*p*-value	PR	95%CI	*p*-value
Sex						
Male	1			1		
Female	1.26	(1.03-1.49)	0.027*	1.25	(1.04-1.50)	0.020*
Economic status †						
Low	1			1		
High	0.41	(0.15-1.09)	0.075	1.41	(0.44-4.49)	0.564
Age						
14-15 years	1			1		
16-17 years	1.06	(0.88-1.27)	0.564	1.05	(0.87-1.26)	0.611
∑2SF						
Normal	1			1		
Elevated	1.02	(0.84-1.25)	0.816	1.01	(0.80-1.27)	0.954
Nutritional status						
Weight normal	1			1		
Underweight	1.38	(1.06-1.79)	0.016*	1.39	(1.06-1.81)	0.017*
Overweight	1.09	(0.84-1.42)	0.516	1.14	(0.84-1.54)	0.414

BCS - Behavior Change Stage; PR - prevalence ratio; CI - confidence interval; † - high economic status (classes A+B), low economic status (classes C+D+E); ∑2SF - sum of two skin fold thicknesses (triceps + subscapular); *$p \le 0.05$.

Table 3 - Crude and adjusted prevalence ratios for a physically inactive behavior stage, by sociodemographic characteristics, body adiposity and nutritional status of schoolchildren from the North of Minas, MG (n=464)

	BCS					
	Crude analysis			Adjusted analysis		
	PR	95%CI	*p*-value	PR	95%CI	*p*-value
Sex						
Male	1			1		
Female	1.55	(1.31-1.84)	<0.001*	1.53	(1.29-1.80)	<0.001*
Economic status †						
Low	1			1		
High	0.72	(0.64-0.81)	<0.001*	0.41	(0.15-1.10)	0.077
Age						
14-15 years	1			1		
16-17 years	1.12	(0.97-1.30)	0.128	1.09	(0.95-1.26)	0.210
∑2SF						
Normal	1			1		
Elevated	1.23	(1.04-1.47)	0.018*	1.21	(1.02-1.49)	0.048*
Nutritional status						
Weight normal	1			1		
Underweight	1.10	(0.91-1.34)	0.307	1.14	(0.96-1.36)	0.558
Overweight	1.01	(0.78-1.30)	0.953	0.92	(0.71-1.20)	0.146

BCS - Behavior Change Stage; PR - prevalence ratio; CI - confidence interval; † - high economic status (classes A+B), low economic status (classes C+D+E); ∑2SF - sum of two skin fold thicknesses (triceps + subscapular); *$p \le 0.05$.

Discussion

This study's principal findings are that PA-BCS differ between the adolescents from the two regions and that sex and that indicators of body fat are associated with inactive behaviors.

The distribution of the samples reflects the differences between the regions investigated and is in line with data from IGBE[11] and the United Nations[12]. The majority of the students in the environs of Januária (MG) have low economic status, which is probably a reflection of the greater incidence of poverty in the area (50%). In contrast, the incidence of poverty in the Midwest of Santa Catarina is around 28%. There is a 22% rate of illiteracy and school truancy among the over-15 population of the North of Minas whereas in the Midwest of Santa Catarina the rate is less than 7.0%. The social and economic conditions in the two regions may be reflected in the lifestyle habits of the adolescents who live there, such as their PA level and body weight status. Hallal *et al*[22] investigated the pattern of PA among residents of the cities of Pelotas, RS, and São Paulo, SP, and found that the prevalence of inactivity was greater in Rio Grande do Sul. The authors attributed their findings to greater opportunities for PA and increased knowledge about PA among residents of the capital of São Paulo state. Monteiro *et al*[23] analyzed body weight status of Brazilian children from different geographical regions and found that the prevalence rates of malnutrition and underweight were greater in regions with lower economic status.

In this study, no significant association was found between PA-BCS and economic status in either of the regions studied. The literature has consistently identified associations between PA and economic status[13,24]. It is possible that the result would have tended to be significant if the samples had been larger and would have revealed that, in the North of Minas Gerais, students with high economic status had a lower probability of inactive behavior than those with low status. Similarly, it is probable that schoolchildren in the Midwest of Santa Catarina with high economic status would have had greater probability of inactive behaviors. A study conducted with adolescents in the city of Pelotas, RS[24], which is an area with a high HDI[12], close to the HDI in the Midwest of Santa Catarina, found that young people with high economic status had higher prevalence rates of inactivity. The authors attributed this finding to greater use of cars and motorcycles by the adolescents with greater spending power, while those with low economic status tended to

walk or cycle. There have been few studies of PA-related behavior in regions with low HDI or with indexes close to the North of Minas Gerais index. Nevertheless, in general the literature shows that in situations of social inequality, young people with greater spending power are more likely to be physically active, more than anything, because they have better social and economic support that allows them to access leisure activities that take place at private clubs, associations and gyms[13].

Age was another variable that was not associated with PA-BCS in this study. Previous research with adolescents in the same age group did not detect a tendency for PA to reduce as age increases[25,26]. Those investigations that have described reductions in PA as age increases were conducted with children in a different age group[27,28].

Female pupils were more likely to have physically inactive behavior in both regions. The literature consistently reports that girls tend to be less physically active than boys[13,24-27,29]. In an investigation of adolescents from Recife, PE, Brazil, 70% of female schoolchildren were in either the precontemplation (7.0%), contemplation (26.1%) or preparation (36.9%) stages, compared with 50% of the male pupils[28]. The differences between the sexes in terms of BCS has been the subject of many studies that have found biological and cultural factors that affect behavior[30,31]. According to Wold and Hendry[30], girls' reduced involvement in physical activities can be explained by sociocultural aspects, since they are directed towards caring for the family and looking after the home from an early age. In contrast, boys are guided towards employment activities, involving greater physical effort. Although the role of women in society has been changing over recent decades, and although this is reflected in children's upbringing and in girls and boys participating in similar activities, the tendency towards reducing the differences between the sexes may be attenuated in towns where the economy is oriented to heavier activities such as agriculture and industry, for example (which is the case in both regions studied), meaning that the behaviors associated with PA remain different for men and women. Another possible explanation for the differences is biological. Bar-Or and Rowland[31] comment that increasing body fat, widening of the pelvis and the discomfort of menstrual periods, all of which take place during adolescence, may be some of the reasons for girls' reduced involvement in PA. Irrespective, more research that focuses on the differences in participation in PA between the sexes is needed in order that policies for the promotion

of an active lifestyle will be more effective and result in people modifying their behavior.

Several different investigators have shown that inactive behavior is associated with increased body adiposity and a risk of overweight/obesity[10,27], as was observed among the schoolchildren from the North of Minas. However, a study undertaken with 25,416 schoolchildren at primary and secondary public schools in Ontario, Canada[32], published results that were the opposite of those from the North of Minas and consistent with the observations made in the Midwest of Santa Catarina, where inactive behaviors were more evident in underweight children. Underweight is related to acute and chronic malnutrition[23,33]. Below-normal BMI leads to growth deficit and metabolic abnormalities which can lead to weakness and indisposition[33], both of which can reduce participation in PA, creating a predisposition towards inactive behavior.

The fact that adolescents with excess body adiposity are more likely to exhibit inactive behaviors has also been observed by other authors[27], who report that the likelihood of being overweight is 73% greater for girls and 74% greater for boys who are classified as physically inactive[27]. Furthermore, the literature suggests that excess fat is strongly associated with physical inactivity and that this condition is a robust predictor of risk of obesity in adulthood[10,34].

This study only investigated adolescents aged 14 to 17 enrolled at public schools in two different regions. Other sectors of the education system, such as technical schools and private schools, were not assessed. Absentee students were not assessed either, so there is no way of knowing whether their behavior is similar to the behavior of those who attend school regularly. The conclusions of this study are therefore only applicable to regularly attending adolescents. Another limitation is the cross-sectional design which prevents any conclusions about relationships of cause and effect between the outcome and the independent variables.

It can be concluded that the regions differ in terms of PA-BCS, indicating that the category with the largest proportion of children from the Midwest of Santa Catarina was the maintenance stage, whereas in the North of Minas Gerais they were at the preparation stage. Another difference was in the association with physically inactive behavior, since in Santa Catarina the prevalence of this behavior was greater among underweight children, while in Minas Gerais the group with greatest prevalence was that comprised of adolescents with excess adiposity. The regions were similar in terms of the fact that female sex was a risk factor for inactive behavior in both study areas.

Interventions are recommended to promote PA in schools and in the community in the areas investigated. Additionally, it is necessary to raise the whole family's awareness of the importance of an active lifestyle if these interventions are to be successful. The use of different strategies for each behavior change stage should be considered, in addition to cultural and economic aspects of the regions.

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