

Association between loneliness, physical activity, and participation in physical education among adolescents in Amazonas, Brazil

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André de Araújo Pinto¹ , Kwaku Oppong Asante^{2,3} ,
Rita Maria dos Santos Puga Barbosa⁴,
Markus Vinicius Nahas⁵, Duana Torquato Dias¹
and Andreia Pelegrini¹

Abstract

Loneliness is an individual and social problem associated with an unhealthy lifestyle among adolescents. We examined the association between loneliness, physical activity, and participation in physical education lessons among school-going adolescents. Participants included 2517 adolescents aged 14–19 years selected from state public high schools in Amazonas, Brazil. Participants answered a questionnaire containing demographic information, physical activity, and participation in physical education lessons and loneliness. Our results showed that physically inactive adolescents and those who did not participate in physical education lessons were more likely to feel lonely. These findings underscore the need to target physically inactive adolescents and those non-engaged in physical education lessons when developing interventions to address loneliness.

Keywords

adolescence, exercise, health risk, loneliness, social health

Introduction

Several risk factors for early mortality have been evidenced in the literature, especially low levels of physical activity (PA), smoking, air pollution, and obesity (Holt-Lunstad et al., 2015). However, social factors have not received due attention, even though they have a similar or greater influence on the risk of mortality in relation to the aforementioned factors (Holt-Lunstad et al., 2010). Living alone, having few social contacts, and limited opportunities to establish social networks are markers of social isolation (Holt-Lunstad et al., 2015).

Among these markers, loneliness is a painful emotional experience associated with sadness

and psychosocial problems especially in adolescence, which tend to manifest more strongly in adulthood (Haugen et al., 2013) with imminent

¹Santa Catarina State University, Brazil

²University of Ghana, Ghana

³University of KwaZulu-Natal, South Africa

⁴Federal University of Amazonas, Brazil

⁵Federal University of Santa Catarina, Brazil

Corresponding author:

André de Araújo Pinto, Research Group on Kinanthropometry, Center for Health and Sports Sciences, State University of Santa Catarina, Rua Pascoal Simone, 358, Coqueiros, Florianópolis-Santa Catarina CEP: 88080-350, Brazil.

Email: andrefsaude@hotmail.com

risk for early mortality (Holt-Lunstad et al., 2015). Possibly, more than any other mental health concern, loneliness has also been linked to depression and suicidality (Cacioppo et al., 2010; Meltzer et al., 2013; Stickley and Koyanagi, 2016). In this context, previous studies have revealed that loneliness was associated with depressive symptoms in children and adolescents (Bohnert et al., 2013; Haugen et al., 2013; Page et al., 2003; Rotenberg et al., 2004; Yaacob et al., 2009), college students (Bonner and Rich, 1991; Joiner, 1997), and the elderly (Heikkinen and Kauppinen, 2004).

Research has revealed, through a systematic review, that participation in PA seems to be positively associated with psychosocial factors in adolescence, such as better psychological well-being and lower level of psychological distress, and negatively associated with feelings of loneliness (Haugen et al., 2013). However, another review has also pointed out that the beneficial effect of PA on loneliness depends on many factors and that loneliness itself can reduce the probability of being physically active (Pels and Kleinert, 2016). With this in mind, PAs that make it possible to create new interpersonal contacts, strengthen relationships with peers, and re-establish affection among friends can be seen as interesting opportunities to alleviate loneliness in adolescence (Fletcher et al., 2003). However, more studies are needed to identify which PAs have the potential to reduce the risk of loneliness in adolescents, as available evidence to date is restricted mainly to the elderly population (Pels and Kleinert, 2016).

In this context, participation in physical education classes has also been shown to be an important behavior for adolescents' health. Participation in school's physical education contributes positively to daily total PA (Pate et al., 2011), improves cardio-respiratory fitness and muscle strength, and reduces body mass index (Erffle and Gamble, 2015; Sanchez-Vaznaugh et al., 2012). Similarly, extra physical education classes reduce the likelihood of being overweight (Klakk et al., 2013) and being at risk for cardiovascular diseases (Klakk et al., 2014). However, few studies have investigated

the relationship between participation in physical education classes and loneliness in adolescents (Fletcher et al., 2003; Santos et al., 2015).

The literature on the relationship between loneliness and PA arises mainly from international studies and has been based on the search for results that meet three main purposes: (1) investigate the associations between the two phenomena; (2) investigate the influence of PA on loneliness; and (2) investigate the influence of loneliness on PA (Pels and Kleinert, 2016). It should be noted that none of the aforementioned purposes has been the focus of empirical studies conducted in Brazilian adolescents.

This suggests that the problem needs to be seen as important by public health agencies, including from the perspective of public policies aimed at preventing or reducing the feeling of loneliness in the population. Although the evidence is strong and not yet sufficiently researched, a search of the literature has not found any studies that have investigated the association between PA and participation in physical education classes (independently of global PA) and loneliness in adolescents in Brazil. Furthermore, it is not also known whether the association follows in the same direction as evidenced in other studies. In view of the aforementioned fact, the purpose of this study was to examine the association between loneliness, PA, and participation in physical education lessons among school-going adolescents in Amazonas, Brazil.

Methods

Population and sample

This school-based cross-sectional epidemiological study is a secondary analysis of data from a survey conducted during the year 2011 in the state of Amazonas, Brazil titled "*Lifestyle and Health Indicators of High School Students in Amazonas.*" The study had as its target population as adolescents of both sexes, aged 14–19 years, enrolled in the high school of the state public education network in five cities of Amazonas (Itacoatiara, Manaus, Parintins,

Presidente Figueiredo, and São Gabriel da Cachoeira). In Amazonas, due to its geographical location (north of Brazil), most of the cities are by the riverside, and in order to reach them, the use of boats is necessary. It was therefore logistically difficult accessing the locations because there was not daily availability of transport to these locations. In this way, the choice of cities participating in the study was intentional because they were located in easily accessible regions.

According to information provided by the State Education Department, 88,562 adolescents were regularly enrolled in the five cities in 2011. Given this quantitative, the sample selection process was determined. In Manaus, the selection process occurred in three stages: (1) proportional by educational districts (a total of six districts); (2) stratified by state public schools, the volume (large: 500 students or more, medium size: from 201 to 499 students and small: up to 200 students); and (3) by cluster of shifts, classes, and school grade, in which the invitation to participate in the survey was extended to all adolescents present in the room at the time of collection. For the cities of Itacoatiara, Parintins, Presidente Figueiredo, and São Gabriel da Cachoeira, the selection stages II and III were employed due to the low number of schools present in the respective cities. In the city of Presidente Figueiredo, since there were only two schools, a census was carried out and all adolescents were invited to participate in the study.

For the sample calculation, it was considered an estimated prevalence of 50 percent (unknown outcome), 95 percent confidence level, sampling error of five percentage points, and correction of the deff effect of 1.5 (Luiz and Magnanini, 2000). To these parameters, 10 percent were added for possible losses/refusals, reaching a minimum required sample of 2485 adolescents (Itacoatiara=580, Manaus=631, Parintins=587, Presidente Figueiredo=264, and São Gabriel da Cachoeira=423). Due to the conglomerate sampling process, in which all those present in the classroom on the data collection day were invited to be part of the research, the number of adolescents exceeded what was estimated, totaling 2517 adolescents.

Measures

The questionnaire used in data collection was elaborated based on the Global School-Based Student Health Survey (Silva et al., 2013), which had its face and content validity previously tested in 117 adolescents, presenting reproducibility values of 0.51–0.96 and considered valid for use in adolescents from 14 to 19 years of age. Socio-demographic information included in the questionnaire were adolescents' gender (male and female), age group (14–16 years and 17–19 years), school grade (first, second, and third), and area of residence (urban and rural).

The habitual PA was estimated by the number of days per week. Subsequently, the variable was categorized and the adolescents who reported not practicing PA were classified as physically inactive, those who did not reach the 60 minutes daily of moderate to vigorous PA as insufficiently active, and those who reached a minimum of 60 minutes daily minutes were classified as physically active (World Health Organization, 2010). Regarding the participation in physical education classes (yes or no), the adolescents were classified as participants if they reported participating in at least one physical education class per week (Mélo et al., 2012).

The dependent variable of this study was loneliness, which was evaluated by means of the question "During the last 12 months, how many times did you feel alone?" having five choices of answers (never, rarely, sometimes, most of the times, and always). The adolescents who indicated the options "most of the times or always" were considered exposed to the feeling of loneliness (Bohnert et al., 2013; Meltzer et al., 2013). The observed *r* reproducibility at by retest at 1- to 2-week intervals was 90.2 percent (Kappa coefficient=0.80, *p* = 0.002).

Procedures

The State Education Department sent a request to all the selected schools, informing them of their authorization to carry out data collection. All the principals of the participating schools

were informed about the importance and the purposes of the research. The data collection was performed by a team of trained researchers, on days and times scheduled with the director and teachers of physical education of each school, who provided their classes for the application of questionnaires. The research team visited all the classes that were randomly selected, providing information to the adolescents about the research in the school, as well as their relevance. Informed consent form (TCLE) was given to participants to be delivered and signed by their legal guardians (for those aged <18 years) or by themselves (age \geq 18 years). The adolescents who accepted to participate in the research and presented the signed informed consent form. The students with disorders (e.g. autism) indicated by classroom teacher were not evaluated.

Statistical analysis

All data were treated using IBM SPSS Statistics, version 20.0 (SPSS Inc, Chicago, IL, USA). Data were presented through frequency distribution (absolute and relative). The possible associations between the feeling of loneliness and PA (habitual and participation in physical education classes) were tested using binary logistic regression (Enter method). The results from the logistic regression analyses are presented as odds ratios (ORs) with 95 percent confidence intervals (CIs). The final model was adjusted for all variables included simultaneously in a single block, and its fit quality was tested using the Hosmer–Lemeshow test. Statistical significance was defined as a two-tailed p -value <0.05 in all analyses.

Results

The general demographic characteristics of the sample are presented in Table 1. Of the 2517 adolescents participating in the study, the majority were female (56.1%), over half (51.9%) were aged 17–19 years old, and approximately 92 percent lived in the urban areas. With regard to the school grade 43.8,

35.6, and 20.6 percent of the participants were in first, second, and third grades, respectively. The majority (71.6%) of the participants considered themselves as insufficiently active when it comes to PA, and as high as 80.5 percent reported to participating in physical education lessons.

Table 2 presents the crude and adjusted results for the identification of the factors associated with loneliness in Amazonas adolescents. It was observed in the crude analysis that all variables were associated with the outcome. After adjustment for all variables with a p value less than 0.20 in the chi-square test, it was found that physically inactive adolescents had higher odds of feeling lonely (OR = 2.09, 95% CI: 1.20–3.71) than the physically active ones. It was also found that adolescents who did not participate in physical education classes were more likely to report feelings of loneliness (OR = 1.41, 95% CI: 1.04–1.80) than those who participate. The adjusted model presented good fit quality by the Hosmer and Lemeshow test ($\chi^2 = 11.025, p = 0.200$).

Discussion

When investigating loneliness in adolescents in Amazonas, the main findings of this study reveal that both physically inactive adolescents and those who do not participate in physical education classes were more likely to feel lonely. These results are similar to those found in international surveys conducted among young people of similar age. For example, among Norwegian adolescents (13–18 years of age) research shows that the practice of PA was directly associated with a lower level of loneliness (Haugen et al., 2013). Other studies with teenagers in the United States (Bohnert et al., 2013) and Taiwan (Page et al., 2003) also find an inverse association between practicing PA and higher levels of loneliness.

In the researched literature, only one study was identified with Brazilian adolescents that sought to partially investigate this association (Santos et al., 2015). The authors, in analyzing the social isolation, through the feeling of

Table 1. Features of the participants in relation to the investigated variables, in the total sample and according to gender in Amazonas, Brazil (2011).

Variables	Total (n=2517), n (%)	Male (n=1106), n (%)	Female (n=1411), n (%)	p value
Age (years)				0.114 ^a
14–16	1210 (48.1)	512 (42.3)	698 (57.7)	
17–19	1307 (51.9)	594 (45.4)	713 (54.6)	
Place of residence				0.015 ^a
Urban	2326 (92.4)	1006 (43.3)	1320 (56.7)	
Rural	191 (7.6)	100 (52.4)	91 (47.6)	
School grade				0.081 ^b
First	1103 (43.8)	516 (46.8)	587 (53.2)	
Second	895 (35.6)	364 (40.7)	531 (59.3)	
Third	519 (20.6)	226 (43.5)	293 (56.5)	
Physical activity				<0.001 ^a
Physically inactive	546 (21.7)	165 (30.2)	381 (69.8)	
Insufficiently active	1802 (71.6)	827 (45.9)	975 (54.1)	
Physically active	169 (6.7)	114 (67.5)	55 (32.5)	
Participation in physical education classes				0.662 ^a
No	490 (19.5)	211 (43.1)	279 (56.9)	
Yes	2027 (80.5)	985 (44.2)	1132 (55.8)	

n = absolute frequency; % = relative frequency.

^aChi-square test for heterogeneity;

^bChi-square test for trend.

Table 2. Logistic regression of the predictors of loneliness in school-going adolescents, Amazonas, Brazil (2011).

Variables	Prevalence	Loneliness	
		Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
Gender			
Female	14.2	1.36 (1.12–1.83)	1.32 (1.03–1.70)
Male [†]	10.4	1	1
Age (years)			
14–16	14.4	1.33 (0.95–1.64)	1.35 (1.02–1.70)
17–19 [†]	10.8	1	1
School grade			
First	14.3	1.41 (0.72–1.51)	1.41 (1.06–1.89)
Second	11.6	1.14 (0.88–1.88)	1.16 (0.79–1.71)
Third [†]	10.1	1	1
Physical activity			
Physically inactive	17.2	2.07 (1.28–4.16)	2.09 (1.20–3.71)
Insufficiently active	11.5	1.38 (0.82–2.53)	1.30 (0.88–2.46)
Physically active [†]	8.3	1	1
Participation in physical education classes			
No	15.9	1.36 (1.08–1.69)	1.41 (1.04–1.80)
Yes [†]	11.7	1	1

OR: odds ratio; 95% CI: 95% confidence interval.

*Adjusted for all variables.

[†]Reference category;

loneliness and number of friends, in more than 4000 adolescents of Pernambuco, did not find associations between loneliness and habitual PA, nor with the participation in the classes of physical education. However, they identified that the adolescents who participated assiduously in the practical classes of physical education were less likely to have few friends.

Although the findings have also been reported by other international studies (Bohnert et al., 2013; Haugen et al., 2013; Page et al., 2003), the reasons why this phenomenon occurs are not, however, well understood, and it is necessary to speculate the reason for this interaction. According to Haugen et al., (2013), there are many variables that could explain the relationship between participation in PA (in any domain) and loneliness, such as perceived social competence, which is understood as how well someone perceives themselves capable of managing their cognitive and behavioral capacities in the treatment of relationships interpersonal (Pinto et al., 2013).

According to previous study (Mahony et al., 2005), participation in PA positively assists the construction of psychosocial skills, as a result of the social relations established during practice, especially in collective PA. Such activities help to prevent or reduce loneliness because they demand a high perception of competence, stimulating acceptance of rules and interpersonal differences (Haugen et al., 2013), reinforcing the idea that people tend to experience greater feelings of companionship and intimacy for those with whom they practice organized PA (Bohnert et al., 2007). Given this, it is believed that being physically active, regardless of the context where PA is performed, contributes positively to the establishment of closer interpersonal relationships with peers in adolescence, so that those who do not allow themselves to engage in some practice feel lonelier by squandering the possibility of establishing social bonds, and perhaps PA, closer to their peers.

In this scenario, school plays an important role in the prevention of loneliness in adolescence because the associations found can be derived from social interaction and, consequently, from the conception of bonds of

friendship established over time during physical education classes (Santos et al., 2015). In the United States, a longitudinal study of almost 1000 adolescent high school students revealed, through their results, that adolescents more frequent in physical education classes, especially in sports, presented a lower chance of social isolation (Barber et al., 2001), corroborating in part with the findings of this study. In this regard, it is intuited that the associations found in this study could be a reflection of PA links built between students over time, especially the physical education classes. Both behaviors have some important social components, such as cooperativity, which allied to this temporality, has contributed to meeting the social expectations of adolescents and, therefore, to minimize the perception of being a loner (Haugen et al., 2013).

It is worth noting that loneliness tends to manifest itself when the relations established between the peers do not supply the quality of the relationship desired by the individual (Russell et al., 2012). Thus, the social mechanisms existing in PA practices, especially in physical education classes, need to be well managed by teachers who must propose activities aimed at favoring positive social relationships among adolescents, in order to prevent the feeling of loneliness. In this sense, it is believed that if the classes are well-mediated by the teachers, the greater the chances of cooperation between the students and, consequently, the possibility of stronger affective ties between them.

This study is not free from methodological limitations, which evokes the need for caution in the interpretation of its findings. The cross-sectional design employed does not make it possible to establish cause and effect relationship between the variables, which is why a prospective design could confirm if the relationship between loneliness and PA practice would not be determined by time. In addition, in view of the design, it is not impossible, also, that loneliness was triggered by conflicting situations that occurred during PA and/or participation in physical education classes but what needs to be clear is that the focus and the purpose of this study was to verify the punctual association between loneliness and the

variables investigated. The use of self-reported measures (including the measurement of the primary outcome) for the evaluation of the variables may have suffered a memory bias. However, it is believed that the questionnaire used to collect data, because it presents satisfactory statistical test–retest parameters, has minimized this limitation. Some variables that can be associated to loneliness (e.g. shyness, self-esteem, self-concept, mental disorders, sedentary behavior—use of computer or cellphone, social competence, variables related to school and family context, and body mass index) were not evaluated. Thus, the absence of these variables may prevent us from knowing whether the associations would be maintained if models were adjusted for these variables.

Among the strengths of the study are the data of adolescents from Amazonas, a region in which research on PA is still incipient. The representativeness of the sample also deserves to be highlighted, including the inclusion of adolescents from urban and rural areas, as well as making possible the external validity of data for high school adolescents of state public schools in the cities involved. Finally, the findings of this study can be used to compare the results of future studies, since the problem investigated still lacks information in the Brazilian adolescent population.

Conclusion

This study provides evidence that not practicing PA and not attending physical education classes are factors associated with the feeling of loneliness in adolescence, suggesting that the associations follow in the same direction. Thus, this study has important implications for physical education teachers, in order to address the importance of regular practice of PA and participation in physical education classes, especially for adolescents who are solitary in class. New research with data from Brazilian adolescents, including prospective design, is necessary to better determine the relationship between PA and the feeling of loneliness in adolescence.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

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Informed consent

Informed consent was obtained from all individual participants included in the study as well as their guardians.

ORCID iDs

André de Araújo Pinto  <https://orcid.org/0000-0002-7931-3987>

Kwaku Oppong Asante  <https://orcid.org/0000-0002-0206-3326>

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