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Does Physical Activity Promotion Advantages Need the Identification of Associated Health Compromising Features such as Injuries, Alcohol Use and Interpersonal Violence? Highlights from HBSC/ WHO Portuguese Survey

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Abstract

A considerable amount of literature demonstrates an association between physical activity (PA) and health. However, some studies also suggest an association between PA and health compromising behaviors. The purpose of this study is to determine the behaviors that can have a positive or negative association with PA in a nationally representative sample of adolescents. Based on the Health Behavior in School-aged Children, 5050 Portuguese adolescents attending 6th (30.8%), 8th (31.6%) and 10th (37.6%) grades (M age=13.98, years, SD=1.85; 52.3% girls) answered a survey concerning a variety of health behaviors and self-perceptions. Results suggested that being more active is positively associated to better nutrition ("eating fruit"), and perceptions of life satisfaction and good health. PA was also associated to violent behavior, injuries and alcohol abuse. It is therefore recommended that practitioners should find ways to promote the several well-documented benefits of PA while monitoring and preventing associated unfavorable outcomes.

Keywords: Health compromising behaviours; Physical activity; Health and well being; Adolescents; Descriptive survey study

Introduction

A considerable amount of literature supports an association between physical activity (PA) and health: individuals who are physically active are described as having better health and experience better life satisfaction [1,2]. Pate et al. identified that less active adolescents reported lower fruit consumption, higher alcohol and marijuana use, cigarette smoking and not wearing seatbelt than more active adolescents [3]. The practice of PA has been identified as a central component of healthy lifestyles [4]. Regular PA participation is important to promote and improve physical and psychological well-being [5,6]. Studies reported that PA improved bone mineral density, cardiovascular health, aerobic fitness, muscular strength and endurance, and mental health [5,7,8]. There is also a significant negative relationship between PA and a careless nutrition, overweight and obesity in adolescence [7,9,10]. Additionally, if incorporated at a young age, PA may persist into adulthood, positively influencing the overall health of populations [11].

The links between PA and health have been addressed in several studies, although a debate is ongoing regarding the methods of PA estimation (e.g., direct or indirect measures), and whether PA is a determinant or an outcome of health, because most of the studies are cross sectional in nature [12-14].

In Portugal, physical activity among adolescents has been stable since 2002 but at lower levels than those recommended by WHO: the percentage of Portuguese adolescents who reported at least one hour of moderate-to-vigorous (MVPA) daily (18.5% of 11-year olds, and, 10% of 15-year olds) is lower than the European average (23% of 11-year olds, and 15% of 15-year olds), older girls are notably inactive (only 6%

of 15 years old girls in Portugal met the guidelines of at least one hour MVPA daily, vs. 10% in the European average) [15-20].

However some studies suggest that PA is also associated with health-related risk behaviours, violent behaviour, incidence of injuries, and the use of doping strategies [21-28]. The fact that PA, especially team sports, are social activities can facilitate a context in which alcohol consumption becomes desirable, e.g. going out with friends to drink after a group physical activity or team sport activity to celebrate the victory or to overcome a defeat, or just to prolong the social event [25,29,30]. MacKay and Vincenten have described that during childhood and adolescence (from 5 to 19 years old) the leading cause of death are injuries related either to home and road accidents or associated to fights, and it is also broadly described the role that alcohol abuse can have in such accidents and violent behaviour [31].

This apparent contradictory relationship between PA and both health behaviors and alcohol abuse, violence and injuries might be due to a number of different factors, including inconsistent measures for

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PA and the context in which physical activity takes, the competitive nature of some types of PA (e.g., competitive sports practice, team sports) that may be more prone to take risks to drink, to be violent and to get injured [8,14,32-36]. Another issue systematically raised is the importance of adults' support and modelling [37-39]. The nature of these associations must be established in order to improve our understanding of adolescents' lifestyles.

The aim of this study was to examine the relationship of PA with three positive health-related indicators (i.e., eating fruit, psychological well-being and health perception) and three negative health-related indicators (i.e., alcohol abuse, fighting and getting injured) available from a national broad adolescents' health survey. The hypothesis is that PA is significantly and positively associated to both health-related and health compromising behaviour, highlighting thus the need to promote the first while avoiding the second in order to improve PA positive effects on adolescents' health.

Methods

Participants

A nationally representative sample of 5050 adolescents (52.3% girls; mean age=14.0 ± 1.9 years), randomly selected nationally from grades 6th (n=1556, mean age=11.8 ± 0.80 years), 8th (n=1594, mean age=13.8 ± 0.8 years), and 10th (n=1900, mean age=15.9 ± 0.8 years), participated in the Health Behaviour in School-aged Children (HBSC) Portuguese survey in 2010 [15]. The HBSC is a large cross-national study sponsored by the World Health Organization (WHO) Regional Office for Europe, methodological aspects are well developed and published internationally [40]. The study received approval from a national ethics committee. All head-teachers gave their consent, and written informed consent was obtained from both the students and their legal guardians.

Measures

Physical activity (PA) in the past 7 days: To assess PA students were prompted with a commonly used broad definition of PA, and then asked "how many days did you practice PA in the last 7 days" [41]. Answers were given in an 8-point scale (1=none to 8=daily). Seven days PA recall is reliable and valid to be used in research on PA in adolescents [42].

Frequency of Sports activities with friends: Adolescents were asked "how often do you practice sports activities with your friends". Answers were given in a 4-point scale (1=Never to 4=one time a week or more).

Body mass index: Based on self-reported height and weight, body mass index (BMI) was calculated using the Quetelet index [weight (kg)/height (m)²]. Adolescents were then divided into three BMI categories: normal weight, overweight, and obese. The cut-off points used to classify the adolescents in normal weight, overweight and obese were based in Cole, Bellizzi, Flegal and Dietz classification [43].

Eating fruit: To identify fruit consumption participants were asked "How often do you eat fruit?" Answers were given in a 7-point scale (1=never to 7=daily, more than once).

Life satisfaction: In order to identify the opinions about Life satisfactions we used the Cantril Self-Anchoring Striving Scale [29]. Adolescents were shown a picture of a ladder with steps numbered from zero at the bottom to 10 at the top. Then, they had to rate the

satisfaction with their current life, considering that the bottom of the ladder represents the worst possible life and the top the best possible life.

Self-rated health: The opinion of young people about their perception of health was collected through the question "you would say your health is?" Answers were given in a selection on a 4-point scale (1=Bad to 4=Very good).

Alcohol abuse in the past 30 days: Alcohol abuse frequency was assessed with a single question that asked "How many times did you get drunk in the past 30 days". Responses were given in a 7-point scale (1=I did not get drunk in the past 30 days to 7=every day).

Getting involved in a fight in the last 12 months: Adolescents were asked how many times during the last 12 months they had been involved in a physical fight. Response were given in a 5-point scale (1=I have not been in a physical fight in the past 12 months to 5=four times or more).

Being injured in the last 12 months in a way that a doctor has been called: Medically attended injuries were measured with a single question that asked "how many times during the last 12 months they had been injured and had to be treated by a doctor or nurse". Response were given in a 5-point scale (1=I was not injured in the past 12 months to 5=four times or more).

Procedure

Questionnaires were administered in schools on January 2010 and were answered anonymously. Participation was voluntary. The administration of the surveys was conducted according to standard guidelines from the HBSC survey protocol and it was carried out by school teachers during class time [40]. Response rate was 84%.

Data analysis

Descriptive statistics were calculated for all variables. A bivariate analysis (Chi-square tests) was undertaken to calculate associations between PA (i.e., the number of days being physically active in the last 7 days) and 1) being drunk in the last 30 days, 2) BMI classification, 3) life satisfaction; 4) being involved in a fight in the last 12 months, 5) being injured so that a doctor was consulted in the last 12 months, 6) perception of health, and 7) eating fruit (Table 1).

In a second step, all the variables were coded so that a higher value corresponded to an increased frequency of the behaviour and z-scores for each variable were calculated in order to study the effect of each independent variable on the PA participation using the Pearson product-moment correlation coefficient. Adjusted analyses were performed for all studied variables using a multiple linear regression, using the *Enter* method. Analyses were conducted for the entire sample and then stratified by gender and age. All statistical analyses were performed using IBM SPSS Statistics 20.0. The level of significance was set at 0.05.

Results

Descriptive statistics are displayed (Table 2), presenting relative frequencies distributions for each variable and the chi-square results. Chi-square tests revealed significant different distributions according to number of days of PA in the previous week.

Physical activity levels as a function of health behaviours

Body mass index (i.e., normal weight, overweight, obese, according

Variables	Range
1-Days being physically active in the last 7 days	1-0 days to 8-7 days
2-How often have been drunk in the last 30 days	1-Never to 7-40 times or more
3- Status/classification concerning weight /overweight	1-Normal ; 2-Overweight; 3-Obese
4- Life satisfaction	0-The worst possible life to 11-The best possible life
5-How often have been involved in a fight in the last 12 months	1-Never to 5-4 times or more
6- Being injured so that a doctor was consulted in the last 12 months	1-Never to 5-4 times or more
7- How do you think your health is?	1-Bad to 4-Very good
8-How often do you eat fruit	1-Never, to 7-Several times a day
9-How often do sports with your peer group in your leisure time?	1-Never, 2-Rarely, 3-Less than once a week to 4-One time a week or more

Table 1: Variables derived from HBSC survey, used for the present study.

	n	%	χ^2 PA practice in the last 7 days	χ^2 Sports with peers in leisure time
			p	p
Body mass index				
Normal weight	3698	81.5		
Overweight	682	15	.09	.07
Obese	156	3.4		
Eating fruit frequency				
Seldom or never	128	2.6		
Less than once a week	257	5.1		
At least once a week	451	9.0		
2-4 times a week	1474	29.5	<.001	<.001
5-6 times a week	605	12.1		
Once a day	976	19.5		
More than once a day	1104	22.1		
Life satisfaction				
0Worst possible life	13	.3		
1	16	.3		
2	19	.4		
3	72	1.5		
4	158	3.2		
5	533	10.8	<.001	<.001
6	527	10.7		
7	932	18.9		
8	1160	23.5		
9	811	16.5		
10 Best possible life	685	13.9		
Self-rated health				
Bad	32	.6		
Satisfactory	614	12.3	<.001	<.001
Good	2651	53.2		
Excellent	1690	33.9		
Getting drunk in the last 30 days				
Never	4517	91.1		
Once or twice	333	6.7		
3-5 times	56	1.1	<.001	.315
6-9 times	20	.4		
10-19 times	12	.2		
20-39 times	7	.1		
40 times or more	13	.3		
Involved in a fight in the last 12 months				
Never	3544	71.6		
One time	693	14.0	<.001	<.001
Two times	297	6.0		
Three times	133	2.7		
4 times or more	282	5.7		
Being injured in the last 12 months				
Never	3065	61.6		
One time	1085	21.8	<.001	<.001
Two times	489	9.8		
Three times	161	3.2		
4 times or more	177	3.6		

Table 2: Variables derived from HBSC survey, used for the present study _ Descriptive data and qui-squares (χ^2).

to Cole et al. classification was not significantly associated with days of PA practice [43].

Pupils, who reported 7 days of PA, reported eating fruit more than once a day (adjusted residual 4.8) more frequently than other pupils.

Pupils who reported doing PA 7 days a week reported more frequently the perception of extreme good life (adjusted residual 6.1) and the perception of having the worst life possible (adjusted residual 1.9). Pupils who reported no PA practice, rated themselves more frequently

as having a worst perception of health (adjusted residual 7.1) rating themselves less frequently as having a “very good” perception of health (adjusted residual -3.7). Pupils who reported PA practice 7 days, reported less frequently the perception of having an fair health (adjusted residual -4.5) or having a good health (adjusted residual -4.5), but more frequently choose the extreme value of perception of a very good health (adjusted residual 7.7).

Participants who reported doing PA during the previous 7 days reported less frequently “never been drunk” (adjusted residual -2.9), and reported significantly more frequently being drunk 20 to 30 times (adjusted residual 5.7), and 40 times or more (adjusted residual 2.7). Pupils who reported PA practice 7 days a week reported less frequent choice of “never being involved in a fight” (adjusted residual, - 8), and reported significantly more frequent involvement in fights 3 times (adjusted residual 4.1), and 4 times or more (adjusted residual 9). Finally pupils who reported PA practice 7 days reported less frequently “never get injured as to have to call a doctor” (adjusted residual - 5.4), and reported significantly more frequently getting injured 2 times (adjusted residual 3), 3 times (adjusted residual 3.2) and 4 times or more (adjusted residual 5.7).

Using as dependent variable “how often do you do sports with your friends during leisure time”, the same pattern of chi-squares significances was obtained: those who do sports more frequently with friends do not differ from other participants regarding BMI, but reported eating fruit more often, were more satisfied with life, perceived themselves as having a better health, were more frequently involved in fights, and were more frequently injured in a such a way that required a doctor’s attendance. No association was found with getting drunk in the last 30 days.

The variable “practice of PA in the last 7 days” was preferred for further analysis to the variable “doing sports with peers during leisure” because this last one referred to a lower level of PA (never, rarely, less than once a week, once a week or more) being not sensitive in the discrimination of children that do sports with peers more than one time a week. Bivariate data was kept regarding both variables, stressing that results are no different for PA and for Sports Practice except for alcohol abuse. BMI classification was dropped from further analyses due to non-association with PA or Sports Practice (Table 2).

Pearson correlation analyses between the number of days of PA practice the last 7 days, and all the other variables were subsequently conducted. This analysis confirmed significant associations of PA with eating fruit, getting drunk in the last 30 days, life satisfaction, being involved in a fight, getting injured so as to be seen by a doctor and better health perception. Pearson correlations were all significant; therefore all the variables were used in the regression models.

A multiple regression model was carried out using PA in the last 7

days as the dependent variable and all the previous variables that were associated with PA practice at a bivariate level as predictors (Table 3). An adjusted model was achieved [F (6,4616)=98.632, $p<.001$], explaining 11.2% of the variance. All predictors were significantly associated to PA practice. The analysis of β values revealed stronger associations with being involved in a fight and getting injured and weaker associations with eating fruit, getting drunk in the last 30 days.

Gender differences

Regression models were then carried out separately for boys and girls: Regarding boys, an adjusted model was achieved [F (6, 2160)=42,975, $p<.001$] explaining 10.4% of the variance. All predictors were significantly associated to PA practice (Table 4). Considering girls, an adjusted model was achieved [F (6, 2449)=33.574, $p<.001$], explaining 7.4% of the variance where all the predictors were significantly associated to PA practice with the exception of alcohol abuse. The association with fruit intake was higher for girls than for boys while the association with health perception, life satisfaction, alcohol abuse and getting injured was higher in boys than in girls.

Grade Differences (as a proxy for age differences)

A regression model was then carried out separately for each school grade, as a proxy for age and developmental differences (Table 4). Regarding the 6th-graders, an adjusted model was achieved [F(6, 1353)=26.261, $p<.001$], explaining 10% of the variance. With the exception of alcohol abuse, all predictors were significantly associated to PA practice. Regarding the 8th graders, an adjusted model also was achieved [F (6, 453)=29.434, $p<.001$], explaining 10.5% of the variance. All predictors were significantly associated to PA practice. Regarding the 10th graders, an adjusted model was achieved [F(6, 1796)=41.74 $p<.001$], explaining 11.9% of the variance. All the predictors were significantly associated to PA with the exception of life satisfaction and alcohol abuse (Table 4).

Discussion

The purpose of this study was to examine the relationship of PA with positive related and negative health-related indicators in adolescents. The positive relationship of PA with eating fruit, good health perception and life satisfaction confirms the positive effects of PA in wellbeing reported in previous researches [4]. But the present results also suggest that PA is positively associated with unhealthy behaviours. These results are in contrast with Nelson and Gordon-Larsen who found that adolescents who performed at least 5 bouts per week of moderate-to-vigorous physical activity were less likely to engage in health-related risk behaviors, and Pate et al. who reported that less active adolescents had higher alcohol and marijuana use, cigarette smoking and wore seatbelt less frequently than more active adolescents [3,23]. The present results add to the body of literature

	Total		Boys		Girls	
	β	p	β	p	β	p
Eating fruit frequency	.102	<.001	.09	<.001	.156	<.001
Life satisfaction	.074	<.001	.082	<.001	.071	<.001
Self-rated health	.152	<.001	.162	<.001	.079	<.001
Getting drunk in the last 30 days	.026	<.05	.043	<.05	.01	0.62
Involved in a fight in the last 12 months	.162	<.001	.124	<.001	.104	<.001
Being injured in the last 12 months	.172	<.001	.177	<.001	.079	<.001
R ²	11.2%		10.4%		7.4%	

Table 3: Regression model using all independent variables and physical activity as dependent variable: total sample and by gender (Enter Method).

	Grade 6		Grade 8		Grade 10	
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>
Eating fruit frequency	.083	<.01	.089	<.001	.104	<.01
Life satisfaction	.101	<.001	.088	<.001	.014	.54
Self-rated health	.137	<.001	.123	<.001	.184	<.001
Getting drunk in the last 30 days	.039	.138	.049	<.001	.042	.07
Involved in a fight in the last 12 months	.158	<.001	.179	<.001	.120	<.001
Being injured in the last 12 months	.137	<.001	.157	<.001	.220	<.001
<i>R</i> ²	10.0%		10.5%		11.9%	

Table 4: Regression model using all independent variables and physical activity as dependent variable by school grade (Enter method).

that links PA to violent behaviour, alcohol consumption and increased occurrence of injuries [24-27,44].

The fact that getting drunk in the last 30 days was only related with adolescents who attend grade 8 suggests that they may consume more alcohol due to a increase of perceived peer norms; studies have shown that most active youths practice PA in formal contexts and it is possible that adolescents are more easily influenced by peer pressure [45,46]. This suggests that interventions should take place before this developmentally critical period helping pupils to deal with peer pressure [23].

The association of PA and violence was stable and consistent across gender and age group proxy. A possible explanation for such stability might be the competitive nature of physical activity and in general of sports activities that increase feelings of rivalry, the “hot cognitions” and the difficulties to self-regulate [24]. The results are consistent with studies that corroborate the association of PA and youth sports practice with youth violence [24,47].

The present study has limitations. First, this study is a cross-sectional correlational design using post hoc measures collected in a previous national global health survey (HBSC/WHO). Second, variables were measured using self-reported behavioural measures, and PA measure did not allow differentiating the several types of physical activities. Nevertheless, this study is conducted using a nationally representative large sample which adds to the scarce literature addressing the relationship of PA with both health promoting and health compromising behaviours among adolescents.

Conclusions

These results have implications in the area of health promotion. First, in accordance with several other studies among adolescents and college students, because lifestyles are the result of a complex network of behaviours, undesirable behaviours associated with PA need to be considered [23,44]. Hence, when promoting PA, messages to prevent drinking alcohol and to reduce violence and injuries, especially among boys should also be addressed. The socialization process through PA has to be monitored as alcohol consumption and fights may be due to conformity to perceived peer norms optimised by group involvement in PA. Indeed, within an ecological framework of health promotion, the importance of family monitoring and family encouragement has been systematically raised as an important component of behaviour change [32,37-39,48].

Perhaps the key issue already highlighted by a few researchers is that what is really desirable is that citizens become “physically educated” for their whole life time [49]. This goal includes the adoption of active and healthy lifestyles, but also encompasses the reduction of substance use, the ability to cope with life challenges and conflicts without engaging

in fights or getting injured. In fact, health in its broad assumption of wellbeing and social engagement and full participation has a major social and economic impact that goes beyond the acquisition of knowledge. Another key change includes promoting PA “for all”, in daily life routines, and across the life span, including all sorts of PA practise, not specifically linked to competition and preferably associated to outdoors cooperative activity [33-36].

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