

Health related behaviours: grouped risks across adolescence

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ABSTRACT

Purpose: Adolescence can be associated with a tendency to engage in health damaging behaviour. The purpose of this study is to test whether cardiovascular disease (CVD) risk factors are present in this age group, and to explore possible moderator variables.

Methods: The database of the Portuguese Health Behaviour in School-Aged Children (HBSC; Currie, Hurrelmann, Settertobulte, Smith & Todd, 2000) study was used comprising a nationally representative sample of 6131 adolescents attending the 6th, 8th and 10th grades (M = 14 years, SD = 1.85). Students answered a self-report questionnaire concerning health behaviours.

Results: An Exploratory Factor Analysis with Promax Rotation yielded a factor solution consisting of four types of risk behaviours: psychological symptoms, substance use, weight inducers, and body concerns and inactivity. Younger students demonstrated the least risky behaviours. Females scored highest in psychological symptoms and body concerns, whereas males scored highest in substance abuse and weight inducers.

Psychological symptoms and body concerns are higher among overweight and obese adolescents compared to normal weight adolescents.

Conclusions: Adolescents already present a number of risk behaviours associated with CVD. This association is moderated by gender, age and Body Mass Index (BMI). Implications are discussed.

Keywords: Cardiovascular risk factors, Health behaviours, Adolescence.

Introduction

Cardiovascular diseases (CVD) are the main cause of death in Western countries, and represent a major economic burden due to increased healthcare costs (Everson-Rose & Lewis, 2005). Prevention interventions, such as those focusing on smoking cessation, improving eating habits and promoting physical activity should be recognized as priorities by the public health system. Behavioural risk factors (e.g., physical activity, smoking habits) are associated with biological factors (e.g., hypertension, obesity, excessive blood lipids) on the onset of CVD. Many of these risk factors are also present in adolescence (Ribeiro et al, 2004a). Because risk factors often persist into adulthood, there is a serious risk of CVD increase in the near future. Early interventions are necessary to prevent development of behavioural risk factors among youngsters (Perry, Klepp & Chultz, 1998). The purpose of this study was to determine the existence of risk behaviours for the development of CVD among a representative sample of the Portuguese school-aged population, as well as to identify possible moderator variables.

Overweight

As obesity is associated with other diseases, it became an epidemic phenomenon (Calderon, Yucha & Schaffer, 2005). In a series of studies with Portuguese youths, children and adolescents at risk for obesity were two times as likely to have two or three other risk factors. Those with the highest levels of body fat were in increased risk for developing hypertension, high cholesterol and less likely to engage in physical activity (Ribeiro et al., 2004b). More active children develop a lower number of CVD biological risk factors (Ribeiro, et al., 2004a). Children and adolescents at "risk for obesity" were 1.5 times as likely to have at least one risk factor (hypertension or low level of activity) (Ribeiro et al., 2003).

Links have also been established between obesity and physical activity in the literature. Kim et al. (2002) found a positive relationship between Body Mass Index and declining rates of physical activity among white and black female adolescents. Similarly, Portuguese adolescents who were obese were significantly less active than non-obese adolescents (Fonseca & Matos, 2005).

Physical Activity

The beneficial role of physical activity (PA) in the prevention of CVD in adults has long been recognized (Powell, Thompson, Casperson & Kendrick, 1987). Compared to active subjects, inactive subjects had a relative risk of 1.5 to 2.4 of developing CVD; these effects were independent of other risk factors. Therefore, engagement in active lifestyles is associated with quality of life. Naturally occurring changes in PA were negatively associated with changes in depressive symptoms among adolescents, raising the question of whether physical activity reduces depression risk in this age group (Motl, Birnbaum, Kubik & Lytle, 2004).

There is evidence that adolescents are not enough physically active and unable to sustain their activity levels into adulthood (Gordon-Larsen, Nelson & Popkin, 2004; Nelson, Gordon-Larsen, Adair & Popkin, 2004). Older adolescents already present lower PA levels than their younger counterparts (Calmeiro & Matos, 1998).

Active lifestyles imply not only increasing physical activity levels, but also decreasing sedentary behaviour. Body weight, in between meals snacking, parental TV watching habits and having a TV in the bedroom are positively associated with youth's TV/video viewing habits (Gorely, Marshall & Biddle, 2004).

Dietary habits

Approximately 25% of adolescent's calorie intake comes from foods high in total and saturated fat, cholesterol and sodium, and low in protein, vitamins and minerals (e.g., soft drinks, candy, cookies, cakes, french fries) (Meredith & Dwyer, 1991).

Snacking while watching TV was associated with higher overall caloric intake, and calories from fat in women (Gore, Foster, DiLillo, Kirk & Smith West, 2003). Eating at fast-food restaurants was associated with excessive weight (French, Story & Jeffery, 2001). Eating quick-service foods twice a week or more was associated with increase in BMI scores in female adolescents; in addition, this behaviour continued from childhood through adolescence (Williams, Holmbeck, & Greenley, 2002). Also, increased consumption of soft drinks is concomitant with decreased consumption of milk in children and adolescents. Conversely, fruits and vegetable consumption is 50% below recommended levels (French, Story & Jeffery, 2001).

Negative affects

Negative emotional states, defined as depressive symptoms, anxiety, anger and hostility, have been associated with increased risk of CVD morbidity and mortality (Everson-Rose & Lewis, 2005; Hemingway & Marmot, 2005). A major depression diagnosis was significantly related to a 4.5 times increased risk of self-reported myocardial infarction (Pratt et al., 1996). Hopelessness predicted a two-fold increase in

the risk of fatal and nonfatal ischemic heart disease in Finnish middle-aged men (Anda et al., 1993).

Type A behaviour was also associated with CVD in non-clinical populations (Hemingway & Marmot, 2005). Men at high risk for CVD who were high in hostility were more likely to die in the 16 years follow-up than those who scored low in hostility (Matthews & Gump, 2002). Anger was associated with a significant four-year follow-up risk of increased hypertension (Everson, Goldberg, Kaplan, Julkunen, & Salonen, 1998).

Smoking and alcohol consumption

Smoking prevalence is higher among adolescents (Rocchini, 1999) and the age of smoking initiation is decreasing rapidly, especially among females (Paulus, Saint-Remy & Jeanjean, 2000; Rius, Fernandez, Schiaffino, Borraz & Rodriguez-Atalejo, 2005). The short-term effects of tobacco addiction among youths include damages to the respiratory system, nicotine dependence and are associated with its consumption until adulthood. Generally, pulmonary function deteriorates more rapidly in smokers of all ages, compared to non-smokers, and it increases the risk of CVD directly through harmful changes in blood pressure, total serum cholesterol and HDL cholesterol levels (Rocchini, 1999).

Smoking prevalence in adolescents in Belgium reached 36% in 17-year-olds, with onset at 15 years of age (Paulus et al., 2000). An increasing trend in smoking habits was also found in Spanish adolescents. Prevalence was 26.0% for males and 22.6% for females, with similar age of onset. In addition, smoking was associated with sub optimal self-perceived health (Rius et al., 2005).

Regarding alcohol consumption, Matos and colleagues (Matos & Equipa do Projecto Aventura Social e Saúde 2003; Matos, Simões, Branco, Urbano & Equipa do Projecto Aventura Social e Saúde, 2004) confirm that alcohol abuse has increased among youth and that these consumers have a higher probability of simultaneously drinking and smoking.

This study aimed to determine the existence of risk behaviours for the development of CVD among a representative sample of the Portuguese school-aged population. Further, we intend to assess how this possible association is moderated by gender, age and BMI.

Methods

Participants and sampling methods

The Portuguese survey reported in this study is a component of the Health Behaviour in School-Aged Children (HBSC) study (Currie et al., 2000). Portugal was included as a full partner for the first time in 1996 (Matos, Simões & Equipa do Projecto Aventura Social e Saúde, 2000; Matos & Equipa do Projecto Aventura Social e Saúde, 2003; Matos et al., 2004), and it has been coordinated to the present date by the first author. This study is based on a self-completed questionnaire, administered by teachers at schools. Classrooms were considered the sampling unit in this survey. Sampled schools were randomly selected from a national list, stratified by region (five Education Regional Divisions, specified below). In each school, classes were randomly selected in order to meet the required number of students for each grade. This number was proportional to the number of same grade mates for each specific region, in accordance to the Ministry of National Education. Questionnaires used in this study were administered in March 2002. Teachers administered the questionnaires in the classroom. Participation in the survey was voluntary and anonymous; no instances of refusal were reported. Distribution and collection of questionnaires at participating schools throughout the country was made by mail and coordinated by the national team. Pupils completed the questionnaires on their own and teachers were only permitted to help with administrative procedures. Pupils left their anonymous questionnaires in an envelope and the last pupil to turn it in was requested to seal the envelope. Filling in the questionnaire required approximately 55 minutes.

This study used a strict international protocol following the Helsinki Declaration on human subject testing. Furthermore, the study was approved by an expert panel at University level, and also by the Education Regional Divisions and by the Schools teachers' board. Informed consent was obtained from the parents.

Survey

The main HBSC survey included questions on demographics (age, gender and socio-demographics), school ambiance, tobacco and alcohol use, physical activity and leisure, nutrition, safety, aspects of psychosocial health, general health symptoms, social relations and social support.

Variables included were: (a) demographics: age ("11-year-old group" including pupils ranging from 10 to 12.99 years; "13-year-old group" including pupils ranging from 13 to 14.99 years; "15-year-old group" including pupils ranging from 15 to 15.99 years; and "16-year-old group" including pupils ranging from 16 to 18 years old); and gender. (b) psychological symptoms ("feeling low", "feeling angry" and "feeling nervous"), (c) substance use ("tobacco consumption", and "spirits consumption"), (d) nutrition ("eating sweets or chocolates" and "eating chips"), (e) self-image ("body weight evaluation"), (f) inactivity ("lack or poor physical activity practice") and (g) sedentary leisure ("watching TV"). Body Mass Index (BMI) was estimated computing self-reported height and weight (Kg/m²) and adolescents were classified as "normal weight" (n=3932), "overweight" (n=674) and "obese" (n=153), according to Cole, Bellizzi, Flegal and Dietz (2001) criteria.

All the dependent variables in the study were recoded to assume the same direction, with higher values corresponding to a less favourable situation. All the dependent variables in the study were ordinal variables and were quantified using an optimal

scaling procedure (Batista-Foguet, Fortiana, Currie & Villalbi, 2004) and thus were dealt with as continuous variables.

Results

The Portuguese HBSC study included 6131 pupils, attending the 6th, 8th and 10th grade ($M = 14$ years of age, $SD = 1.85$) from 125 randomly chosen schools. Fifty-one percent of the participants were females and 49% were males. According to grade level, 38.6% of the students were in the 6th grade, 35.6% in the 8th grade and 25.8% in the 10th grade. The decrease of pupils in higher grades reflects population trends. The schools represented the entire country, stratified by geographically structured Education Regional Divisions. Hence, pupils were distributed as follows: North (42.9%), Centre (17.7%), Lisbon (30.7%), Alentejo (4.1%), and Algarve (4.5%). The response rate among schools was 93%, whereas the rate among students was 83%.

Data analysis

A preliminary analysis of the frequency of ten risk behaviours potentially associated with cardiovascular health yielded the following results: feeling low weekly or more often (19.8%), feeling angry weekly or more often (17.6%), and feeling nervous, weekly or more often (28.8%), daily tobacco consumption (8.5%) and spirits consumption weekly or more often (12.3%), eating sweets or chocolate daily (23.2%), eating chips daily (22.3%), considering oneself "fat" (31.9%), physical activity once a week or less often (15.4%); watching TV 4 hours a day or more (33%). In addition, based on BMI estimates, 82.6% of the subjects had "normal weight", 14.2% were "overweight" and 3.2% were obese, according to Cole et al. (2001) cut-off points.

An exploratory factor analysis (principal components) with Promax Rotation and Kaiser Normalization was performed on all ten risk behaviours. Four factors emerged explaining 58.1% of the variance in the subjects' reports of risk behaviours. (1) psychological symptoms, including feeling low, feeling angry and feeling nervous (factor loadings of .753, .812, and .791, respectively); (2) substance use, aggregating tobacco consumption, and spirits consumption (factor loadings of .862, and .850, respectively); (3) weight inducers, grouping eating sweets or chocolates, eating chips, and watching TV (factor loadings of .681, .611, and .686, respectively), and (4) body concerns and inactivity, comprising perception of body weight and physical activity (factor loadings of .736 and .488, respectively). When Maximum Likelihood, as a factor estimation method was used, the four factors structure was not rejected.

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Factor values were not all normally distributed and there was not heterocedasticity of the within-group distribution. Thus, a non-parametric Kruskal-Wallis technique was utilized to compare risk behaviours between males and females (Table 1). Females scored higher in Factor 1 (psychological symptoms) and Factor 4 (body concerns and inactivity), whereas males scored higher in Factor 2 (substance use), and Factor 3 (weight inducers).

Table 1 - Comparisons of grouped risks across Gender - Kruskal-Wallis.

	Gender		Kruskal-Wallis χ^2	P
	Male	Female		
	Mean Rank	Mean Rank		
Psychological Symptoms	2720	3399	225.42	.000
Substance use	3115	3019	4.47	.035
Weight inducers	3196	2941	31.84	.000
Body concerns and inactivity	2658	3458	313.09	.000

Note: $df = 1$, for all χ^2 (Kruskal-Wallis)

Table 2 depicts the results of Kruskal-Wallis comparisons for age. Results show that the 11-year-old group scored less in all four factors. Factor 1 (psychological symptoms), Factor 2 (substance use) and Factor 4 (body concerns and inaction) increased steadily between the 11-year-old and the 16-year-old groups. Factor 3 (weight inducers) kept the increasing pattern but, in the last age group, it seems to begin declining.

Tabela 2 - Comparisons of grouped risks across Age group - Kruskal-Wallis

	Age Group				Kruskal-Wallis χ^2	p
	11	13	15	16+		
	Mean Rank	Mean Rank	Mean Rank	Mean Rank		
Psychological Symptoms	2735	3022	3202	3284	68.94	.000
Substance use	2063	2651	3524	4203	1046.7	.000
Weight inducers	2735	3117	3223	3059	57.1	.000
Body concerns and inactivity	2813	2981	3157	3356	61.74	.000

Note: df = 3, for all χ^2 (Kruskal-Wallis)

Finally, Table 3 illustrates differences in risk behaviours across BMI. "Normal weight" subjects score less than both "overweight" and "obese" subjects in Factor 1 (psychological symptoms) and in Factor 4 (body concerns and inactivity), whilst "overweight" scored higher in Factor 2 (substance use) and "normal weight" scored higher in Factor 3 (Weight inducers).

Tabela 3 - Comparisons of grouped risks in different BMI Groups - Kruskal-Wallis

	Body Mass Index			Kruskal-Wallis χ^2	P
	Normal	Over weight	Obese		
	Mean Rank	Mean Rank	Mean Rank		
Psychological symptoms	2470	2692	2618	13.33	.001
Substance use	2327	2787	2305	103.9	.000
Weight inducers	2756	2667	2473	14.8	.001
Body concerns and inactivity	1942	2610	3481	397.9	.000

Note: df = 3, for all χ^2 (Kruskal-Wallis)

Discussion

The purpose of this study was to determine the existence of risk behaviours for the development of CVD among a representative sample of the Portuguese school-aged population. Consistent with previous research conducted in Portugal (e.g., Ribeiro et al., 2004a), adolescents in the present sample already present a number of risk behaviours that can lead to adult CVD. These results are also consistent with studies from other countries. For example, 9% and 11% of Norwegian boys and girls, respectively, reported current daily smoking, which was already associated with multiple health problems (Holmen, Barrett-Connor & Bjermer, 2000). In a sample of Australian 18-year-olds (who were recruited at the age of nine), cluster analysis revealed that smoking, excessive alcohol consumption, and adverse dietary choices clustered among both males and females, with physical inactivity also clustering among females (Burke et al., 1997). Overall, these results indicate a serious health issue in Western civilization countries.

Females reported more psychological problems, body concerns and inaction than males. Significant inverse relationships between body dissatisfaction and self-esteem have been supported by other studies (Furnham, Badim & Sneade, 2002). Females reported lower body self-evaluations than males, regardless of age (Mendelson, Mendelson & White, 2001). Males reported higher substance use and weight inducers consumption. Higher prevalence in smoking was found among adult males (Rius et al., 2005).

Younger students (11-year-olds) reported the least amount of risk behaviours. Psychological problems and weight inducers increase at age 13 and in the 15-year-old group, and body concerns and inaction were more prevalent in the 16-year-old group. Overall, these results are consistent with the vast body of literature documenting lower

levels of physical activity for young girls and older female adolescents (Calmeiro & Matos, 2005). To minimize continuous decreases of PA into adulthood (Gordon-Larsen et al. 2004; Nelson et al., 2004), programs should focus on how to maintain an active and healthy lifestyle (Calmeiro & Matos, 1998).

The present study also reflects an increased concern over body image and psychological symptoms for overweight and obese students. Being overweight and obese is associated with excessive caloric intake and/or insufficient caloric expenditure; in this case "normal weight" seems to report the higher caloric intake, but also more caloric expenditure. Lack of recommended levels of physical activity is concurrent. Additionally, as discussed above, body image concerns are often associated with low self-esteem and negative affective consequences. In a previous study (Fonseca & Matos, 2005), poor body image in Portuguese adolescents was associated with BMI, dieting behaviors and attitude toward appearance; those who were overweight considered themselves less healthy.

Dietary intervention should focus on creating awareness on nutritional needs and identifying and monitoring healthy foods consumption, while limiting high-fat and high-sugar foods (Calderon et al, 2005). Often, adolescents have limited control over what they eat at home; therefore, involving families is likely to be more effective.

Smoking and drug use prevention programs should focus on developing adolescents' awareness of social influences, and the acquisition of specific skills to identify and resist those influences, by practicing health-enhancing alternatives, and correcting misperceptions of social norms regarding risk-taking behavior (Perry et al., 1998; Matos, 2005).

Identification of risk behaviours in adolescence sanctions the development of appropriate universal prevention interventions to decrease the probability of development of CVD later in life. Effective interventions should involve the variety of adolescents' interpersonal contexts in an ecological perspective.

School seems a privileged environment for the implementation of health programs, especially when interventions also emphasize the supporting role of peers and family (Calmeiro & Matos, 2005; Matos, 2005). Frequently, acknowledgement of health-related information or beliefs about lifestyles is by itself insufficient to promote change. Educational approaches should focus on developing adolescents' life skills, as adolescents often face tasks that require competencies acquisition, emotion managing, becoming autonomous and developing mature relationships and personal integrity (Danish, Fazio, Nellen & Owens, 2002; Smalley, Wittler & Oliverson, 2004; Botvin & Griffin, 2004; Matos, 2005) in order to cope with daily life and future challenges.

Classroom-based training involving instruction, modeling and role-playing can assist students to identify and prepare for roadblocks in the process of resisting social influences and changing norms. Emphasis should be placed on perceptions of competence, autonomy and personal efficacy. As several health-damaging behaviours are likely to co-exist, researchers should assess the development, implementation and evaluation of multiple component intervention programs (Calmeiro & Matos, 2005; Botvin & Griffin, 2004; Matos, 2005).

Results of the present study stress the need for early health protective interventions (Everson-Rose & Lewis, 2005) and for multiple component intervention programs

(Ribeiro et al, 2004b). Furthermore, this study highlighted the importance of addressing different patterns of risk behaviours according to gender and BMI groups (normal weight, overweight and obese) (Perry et al., 1998). Once there is a relationship between lifestyle health behaviours and biological risk factors (Guerra et al., 2003), interventions aiming lifestyle changes in youth are likely to help prevent CVD in adult life.

The present study has some limitations. First, the variables used in this study were developed post hoc from an existing survey. Second, the findings are based on adolescents' self-reports, so biases in perception and reporting cannot be ruled out. Notwithstanding these limitations, this study ensured a nationally representative sample. Moreover, to the best of the authors' knowledge, this study is the first nationwide investigation about the development of risk behaviours for cardiovascular health through adolescence, taking into consideration gender and BMI.

Key points:

1) Portuguese adolescents already present a number of risk behaviours that can lead to adult CVD. Results support the claim that universal prevention of CVD risk behaviours should begin at least in early adolescence (Matos, 2005), and should include a broad scope of health protective behaviours (psychological well-being, nutrition, substance use, physical activity and leisure)

2) Normal weight, overweight and obese adolescents, presented specific protective needs, and these have to be addressed in health interventions.

3) Males and females go through different behavioural pathways towards CVD risk. Gender differences should thus be addressed.

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