Risk factors for coronary disease in elementary and high school students

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ABSTRACT

This work aimed at pinpointing some risk factors of coronary artery disease (CHD) in schoolchildren from elementary and high schools during the 1995 academic year, in Bauru, SP. The presence of risk factors such as arterial hypertension, obesity, sedentary life and family story was investigated in a group of 336 students ages between 11 to 20. The average age was 15 years and 9 months (DP 2.3). One hundred and sixty eight female and male students were evaluated. Obesity was found in 92 (27.4 %) children. The sedentary life condition linked to maximum oxygen intake was found in 65 schoolchildren (19.3%). Cardiac problems observed until age 50 in male relatives, and 55, in female relatives, suggest that 54 schoolchildren (16.0%) indicated positive family story. Thirty-two students (9.5%) had blood pressure above percentile 95 in relation to height 50 and 75 percentiles. One hundred fifty students (44.6%) showed at least one risk factor. These results suggest that preventive educational measures for a healthier lifestyle should be discussed in school.

Key words: risk factors, coronary artery disease, schoolchildren.

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INTRODUCTION

Cardiovascular disease comprises a variety of heart and blood vessels diseases, among them the Heart Isquemic Disease (HIC), cerebrovascular disease and cardiac failure (Lotufo, 1996). In the present study, these diseases will be summarized as Cardiovascular Disease (CVD) and HIC will be mentioned as coronary disease (CD).

Cardiovascular disease is the main cause of death all over the world, mainly in countries of the first world, although these conditions have a universal prevalence (Matta & Rocha, 1991).

In Brazil, since the beginning of the systematic register of death in the early 30´s until the 60´s CVD appeared as the second cause of mortality. From the 70´s on took the first place. In the 90´s CVD accounted for the main cause of mortality for both sexes in all macroregions of Brazil, including the North region. The magnitude of chronic diseases in the register of mortality was established in the 60´s when the group of CVD surpassed the parazitary and infectious diseases in the capitals of the country. With the exception of the states of Amazonas, Rondonia and Roraima, all remaining states showed these diseases as primary cause of death (Lotufo, 1996).

The physiopathological process that leads in morbidity and mortality of CVD starts in the very first years of life and shows a long subclinical phase. This means that angina, heart attacks and sudden death are rare occurrences in childhood. However, the aterosclerotic process stars in the early childhood. The negative repercussions due to this conjunct of disease in the society is revealed by the high index of work absenteeism and invalidity, despite the cases that evolve to death of individuals of both sexes in the productive age (Gerber, 1992).

Scientists and doctors can identify directly or indirectly the risk factors for the development of coronary disease, which could lead to heart attack, death or chronic invalidity. These risk factors are commonly used by doctors as indicators of the development of this disease as well as to follow up its progress during treatment. More recently, these indicators are quite important in the early prevention of this disease.

A risk factor is an identifiable characteristic, which is associated to at high expectancy in the incidence of the disease (*American Heart Association*, 1995). From the epidemiological point of view, a risk factor is a factor of exposition allegedly associated to the development of a disease, which can be genetic or environmental and acts before the onset of a given disease [1]

A recent statement of the *American Heart Association* (AHA) suggest two classifications for risk factor related to coronary disease: the *principal* and the *contributive*. The *principal* are those that medical research have appointed as definitely associated to a significant increase in the risk for cardiovascular disease and may be classified as irreversible (age, sex and family story) and reversible (smoking, arterial hypertension, hypercholesterolemy and sedentarism). The *contributive* risk factors (diabetes, obesity and stress) are those associated to an increase in cardiovascular risk although their significance and prevalence have not yet been fully determined. In this classification it is important to note the sedentarism as a *principal* risk factor for coronary disease.

These variables are easily diagnosed in the adult population and, presently, they are also present in the adolescence and even in childhood.

PREVALENCE OF RISK FACTOR FOR CORONARY DISEASE IN CHILDREN AND ADOLESCENTS

Many epidemiological studies conducted in adults have established clearly the relation between antecedent risk factors and consequent coronary complications. Recently, this model has been extended to children.

Becque et al. (1988), studying the incidence of some risk factors for CD arrived to astonishing results in 36 obese adolescents. Ninety-seven per cent of the sample showed four or more risk factors. The most alarming data was that two individuals presented all studied risk factors: serum triglicerids, HDL-cholesterol, total cholesterol, diastolic and systolic blood pressure, maximal working capacity, obesity and family story.

Boreham et al. (1993), in an important epidemiological study, concluded that the mortality rate for CD in Northern Ireland is among the highest in the world. In the mentioned study the sample included 1015 school children distributed in four groups according to age and gender: 251 boys and 258 girls 12 years old and 252 boys and 254 girls 15 years old. Results revealed that 14 to 24% of the children have hypertension; 11-24% exceeded acceptable levels for cholesterol and 16-24% were smokers. A great proportion of the children (18-34%) were also under risk due to excess of body fat, poor physical activity (24-31%) and low cardio-respiratory capacity (23-30%). Finally, 26 to 32% had a positive family story. These percentages take into consideration the amplitude of values among different groups.

In Brazil (Matta & Rocha, 1991) studied the frequency and the behavior of risk factors for CD in 292 children with age ranging from 5 to 16 years, presumed healthy and pertaining to a low levels in terms of socio-economical situation. In this sample, 38 children (13%) showed one risk factor while 10 children (3.4%) accumulated two or more factors. Obesity was detected in 4.1%, hypertension in 5.8%; increased total cholesterol in 6.5% and the family story was positive in circa 83.0%. Authors found a strong association among these factors.

Gerber (1992) studied the profile of some risk factors for coronary atherosclerosis in 1501 school children in Bento Gonçalves, RS. The level of seric cholesterol was studied and its association to hypertension, obesity and family story. It was also included the relations to gender, age, race, socio-economic level, besides the dosage of other seric lipids (triglicerids and lipoproteins). There were 420 children (27.9%) with cholesterolemia above 180mg/dl and, among these, 189 (12.6%) above 200mg/dl, 72 (4.8%0 above 220mg/dl and 24 (1.5%) above 240mg/dl. The arterial pressure was above the percentile 95 in 75 (5.0%) children for systolic arterial pressure and 48 (3.2%) for diastolic arterial pressure, without relation to the socio-economical status. Ninety-five (6.3%) children have body mass index (BMI) above the percentile 95 and the family story for sudden dead was positive in 161 cases evaluated (38.3%). The author suggests that risk factors for CD are prevalent in childhood and, in this particular study, the most prevalent one is hypercholesterolemy.

Considering that physical education at school, mainly in the elementary and high school, has an important role to play in the education of children and adolescents, this study aims to quantitatively diagnose some risk factors for CD in school children, such as sedentarism and obesity, which can be controlled and even reverted by means of an adequate educational intervention. Studies in this area reveal that children in school age show many risk factors, which in adulthood are predictive for CD and thus the primary prevention for aterosclerosis should be started early.

OBJECTIVE

There is no available data on the prevalence of risk factors for coronary disease in school children of the elementary and high school level of the government system in Bauru, SP. In this regard, this study aims to investigate some factors considered as of risk for coronary disease among school children of the state schools in Bauru, SP, during the 1995 school year.

METHODOLOGICAL PROCEDURES

The present study is characterized as individual, descriptive, non-experimental, contemporary, with random sample from basic (5^{th} to 8th grades) and high school under the responsibility of the Education Department (ED) of Bauru, SP in 1995.

The Bauru ED, in 1995, supervised 28 schools with classes for 5^{th} and 8^{th} grades, besides 16 schools offering these grades and also the high school. For the sample, fourteen schools of the elementary level were randomly selected and seven from the high school level. There were 24186 school children enrolled in both levels according to data furnished by the Technical and Planning Assistance (TPA). Out of this population, 336 school children were randomly selected to constitute the sample. The sample size was defined taking into consideration the results obtained in a previous study (Maitino, 1994) and established according to a 95% level of confidence level and error margin estimated in 10%. Data collection was made between October and November 1995.

According to the specificity of the present study, it is assumed that arterial hypertension, obesity, sedentarism and family story are risk factors for coronary disease. The collection of other risks such as smoking, hyperchilesterolemia, diabetes and stress do not apply.

The anthropometric evaluation of the body composition is based in measures of body weight, height, skinfolds and circumference, and has been frequently used in field and clinical works. In the present study the antropometric parameters were: body mass index (BMI) and the method of skinfold. BMI is frequently used in epidemiological studies to identi-

fy malnutrition and obesity. It is calculated by dividing the body weight by the square height (body weight / heigh[1]). It is important to note that this index diagnoses excess of body weight, but does not determine the type of the predominant component. The method of cutaneous fold proposed by Slaughter et al. (1988) consists of he measure of the tricipital and subscapular folds, which equation are recommended to predict the percentage of body fat (%F) in children raging from 8 to 17 years old. According to the author these equations decrease the influences of malnutrition and race factors.

From 17 years and on, it was used the methodology proposed by Guedes (1994) that includes the measure of three skinfolds differentiated according to sex. For female adolescents the subscapular, suprailiac and thigh folds are measured. For males, the measure is made in the tricipital, suprailiac and abdominal folds. In these cases, the fat percentage (%F) is estimated according to tables proposed by the same authors. The measures were made with an adipometer Cescorf with a precision of 1mm.

Body overweight was established for values of BMI above 25kg/m^2 as proposed by Lohman (1992). In the same way, for %F it was established values of 30 and 20% for females and males, respectively, according to Dwyer & Blizzard (1996). The estimation of $VO_{\leq}$max. was indirectly evaluated in a Monark cyclergometer with mechanic friction after a protocol proposed by Astrand with adaptation suggested by Duarte (1983). It was chosen the velocity of 50 RPM, which facilitates the calculus of estimated $VO_{\leq}$max. The initial load applied was (1) 225Kpm/minute (37,5 W) and 300Kpm/m (50 W); the final load was (2) 525 Kpm/minute (87,5 W) and 600Kpm/minute (100 W) for females and males respectively. Cardiac frequency was counted at the fourth minute after load 1 and at the fourth minute after load 2. This measure was used to predict the maximal consumption of oxygen in liters per minute in a nomogram of Astrand as mentioned by Duarte (1983). Afterwards, the value in liters per minute was adjusted according the body weight and reported in ml/kg/min. Minimal limits for this variable were 30 and 35 ml/Kg/min for females and males, respectively, according to Bell et al. (1986).

Family story was collected by means of questionnaires as proposed by Sveger et al. (1987) based on the following question: parents, grandparents and brothers presented any cardiovascular disease, such as angina, heart attack, before age 50 for males and before age 55 for females? Alternative answers were: no; do not know, and yes. If positive, who and at which age?

The questionnaire included space for parents or guardian's authorization of his/her son to participate in the study.

All procedures for measurement of blood pressure values followed the recommendations of the *Report of the Second Task Force on Blood Pressure Control in Children* (1987), an epidemiological study that established the guidelines for approaching blood pressures issues in children and adolescents. Recently, it was included values of percentile for

2 SCHMIDT, M.; DUNCAN, B.B. Epidemiologia clínica: a aplicação do método epidemiológico na pesquisa e na prática médica. Universidade Federal do Rio Grande do Sul, 128 p. (notas de aulas).

height in the diagnostic classification of the blood pressure levels as reported in the *Update on the 1987 Task Force Report on Blood Pressure in Children and Adolescents* (1996).

In the present study, it was considered, besides gender and age, the percentile 95 of blood pressure as regards the percentiles 50 and 75 for height as baseline values, above with the blood pressure would characterize a condition of hypertension according to the tables suggested by the III Brazilian Congress of Arterial Hypertension (1998).

Measures were made with an apparatus with mercury column (Wan Ross) and a B-D stethoscope.

RESULTS

Age

In the period of the study (October-November, 1995) the sample (n = 336) had an average age of 15.8 years (standard deviation 2.3) and the age band varied from 11 to 20 years.

Obesity profile

As regards the BMI, 29 (17.3%) girls (n=168) and 28 boys (16,7) (n=168) showed values above 25kg/m^2. Considering the skinfolds, 46 (27.4%) girls and 36 (21.4%) boys exceeded the cut-off values (30 and 20 %, respectively for %F).

Independently from the measuring instrument, 49 girls (29.1%) and 42 boys (25.6%) showed values above 25kg/m^2 for BMI and values of 30 and 20% for %F. Thus, obesity was found in 92 schoolchildren (27.4%). It is important to note that 45 cases evaluated (13,4%) presented values above of the cut-off limit established for both procedures.

Evaluation of the maximal consumption of oxygen

For this study, taking into consideration values proposed by Bell et al. (1986) to define sedentarism, 34 females (20.2%) (n=168) and 31 (18.4%) (n=168) males were included in this condition, showing $VO_{\leq}max$ lesser than 30 ml/kg/min for females and 35ml/kg/min for males. Thus, 65 schoolchildren (19,3%) out of 336, may be included in the condition of sentarism, considering the limitations of the instrument used for measurement.

Data on family story

According to the answers provided by the questionnaire, family story was positive in 54 cases (16.0%), negative in 238 (70.8%) and unclear in 44 cases (13.1%). The organization of the questionnaire

allowed the verification of cardiac problems according to the parental relation. Thus, six cases of familiar aggregation were noted: 5 children reported cardiac problems in grandfather and grandmother and one in his/her father and mother.

Behavior of the blood pressure values

According to the cut-off value, 15 female schoolchildren (8.9%) (n=168) showed values above the percentile 95 as regards the percentiles 50 and 75 for height. In the same way, 17 male schoolchildren (10.1%) (n=168) showed blood pressure above the percentile 95 as regards the percentiles 50 e 75 for height. This means 32 cases (9,5%) showing blood pressure above the normal.

Data on risk factors

Obesity was the most common variable followed by sedentarism, family story and arterial hypertension. TABLE 1 shows these variables in the studied sample.

TABLE 1 - Presence of risk factors for coronary disease in the sample of the state education system in Bauru, SP., 1995

RISK FACTORS PRESENCE %	Female	Male	Total	(n=336)
OBESITY	49	43	92	27,4
SEDENTARISM	34	31	65	19,3
FAMILY STORY	29	25	54	16,0
HYPERTENSION	15	17	32	9,5

TABLE 2 shows the presence of risk factor inside the sample (n=336).

TABLE 2 – Quantification of the presence or absence of risk factor in the sample (n=336) by sex in the state educational system, Bauru, SP, 1995

SEX	PRESENCE	ABSENCE	TOTAL
FEMALE (n=168)	79 (47,1%)	89 (52,9%)	168
MALE (n=168)	71 (42,3%)	97 (57,7%)	168
TOTAL	150 (44,6%)	186 (55,4%)	336

Accumulation of more than one risk factor may potencialize the clinical manifestation of coronary disease in the adulthood. TABLE 3 analyses this possibility.

A hundred-fifty cases (44.6%) showed at least one risk factor. A girl and a boy accumulated the four factors studied.

TABLE 3 – Quantification of evaluated cases that showed one to four risk factors, by sex, in the state educational system, Bauru, SP., 1995

SEX	NUMBER OF RIKS FACTORS				
	1	**2**	**3**	**4**	**TOTAL**
FEMALE (n=168)	41	29	8	1	79
MALE (n=168)	39	20	11	1	71
TOTAL (n=336)	84 (23,8%)	49 (14,6%)	19 (5,6)	2 (0,6%)	150 (44,6%)

DISCUSSION

The interpretation of the results of this study should be careful. According to Boreham et al. (1993), this process remains essentially intuitive and arbritary, despite the many attempts to standardize the limits for pediatric risk.

In general terms, results of this study do not differ substantially from other studies (Armstrong et al., 1990, Boreham et al., 1993, Matta & Rocha, 1991), despite minor differences in cut-off values and in the methodology.

Obesity was the most prevalent variable. Indeed, some anthropometric characteristics, such as body weight and height, are regularly used in studies that analyze the patterns of children growth. According to Guedes (1994), the lean index component in girls and boys shows similar values in ages from 7 to 13. Only after age 14 do gender differences become statistically favorable to boys.

Taking into consideration the methodological procedures proposed by Slaugther et al. (1988), which were used in the present study, to estimate the relative percentage of fat by measuring the skinfolds, besides the BMI, obesity occurred in 27.1% of the cases. This value, in percentile terms, is not substantially different from those reported in studies conducted in other social conditions. As a matter of fact Lauer et al. (1975), in an epidemiological study, reported 23.0% obese school children; Armstrong (1990) 14.0% and Boreham et al. (1993), 34.0%.

This situation could be, in some way, connected to the nutritional transition commented by Lotufo (1996) that points out to the relevant role of diets in the development of some disease. If, on the one side, the improvement of the health conditions in different social conditions is due to the improved access to food, on the other side the possible excesses may be determining an increase in the rates of prevalence and mortality by chronic diseases.

Discussing the relation that is aimed to establish a connection between maximal oxygen consumption and sedantarism, it is important to consider the limitations of the tests employed to assess the physical condition of the children, not to mention the difficulty into determine

limits to this variable from which one can consider a child or adult as having a healthy cardiorespiratory system or presenting condition of sedentarism.

The methodology employed in the present study to estimate the maximal consumption of oxygen revealed that 14.3% of the children presented low cardiorespiratory capacity. Boreham et al. (1993) reported 23 to 30% in the same situation in their study. Maitino (1994), in a study with schoolchildren of the 5^{th} and 8^{th} grades and using the walking/running test for 12 minutes as proposed by Cooper (1968), reported 42.0% of the cases with oxygen consumption equal or less than 28.8ml/kg/min for girls and equal or less then 33.2ml/kg/min for boys.

The cardiorespiratory fitness has been associated with coronary risk in adults and children. Bell et al. (1986) suggest that the lower limit of aerobic potency that in the absence of other health problems may represent some risk, is 35ml/Kg/min for boys and 30ml/Kg/min for girls.

Comparison of results from the family story in relation to other studies is harmed due to the differences of the methodology used. In this way, Matta & Rocha (1991) found 83.0% of positive cases for family story. In the present study it is reported only 16.0%.

Results for the presence of at least one risk factor are also contradictory regarding the studies mentioned above. In the first, 79.2% showed one risk factor and in the second, 23.8%.

Although 32 cases presented blood pressure values above the percentile 95, combined with the percentiles 50 and 75 for height, which means 9.5% of the cases, it should be considered that its measure is an estimation and that the diagnosis of arterial hypertension is beyond the scope of the present study. It is important to note that, in percentage, the result of this study (9.5%) is close to the ones reported by Matta & Rocha (1991) (5.8% in schoolchildren with age raging from 5 to 16) and to the results of Lauer et al. (1975) (8.9% in schoolchildren with age ranging from 14 to 18). However, Becque et al. (1988) reported 64.0% of hypertension in a sample of obese adolescents.

Regardless the variability of the results reported in many studies, it is clear that arterial hypertension can be diagnosed in pediatric samples.

This being the case, this study confirms the presence of many factors considered as risk factors for coronary disease in a sample of children and adolescent allegedly healthy and at school age.

FINAL COMMENTS

A variety of investigations in different social settings, such as the studies by Gilliam et al. (1977), Akerblom et al. (1985), Barna (1992), Gerber (1992), Raitakari et al. (1997), support the occurrence of risk factor for coronary disease among children and adolescents. Some of these risk factors were found in the studied sample, being obesity the most

prevalent followed by sedentarism and hypertension, among those potentially reversible. Taking into consideration that 49 cases (14.6%) showed two risk factors and that 19 cases (5.6%) accumulated three factors suggests that the summation of many risk factors may occur in children and adolescent at school age, as occurs in adults of both sexes.

Considering that, in adults, these factors are predictive of coronary disease the importance of preventive measures taken in the childhood, mainly by educational means becomes clear. The clinical approach to hypertension is a medical issue. However, the fight against sedentarism should be a concern of Physical Education at school as it cares about body movements as a field of knowledge.

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