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Household cardiovascular screening in adolescents from high-risk families

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ABSTRACT

Background: Some cardiovascular risk factors identified in adults are already present in many children.
Objective: To identify adolescents that are at risk for developing cardiovascular disease based on the presence of risk factors in their parents and their own lipid profiles, fasting plasma glucose, and blood pressure.
Methods: 182 families were selected. The adolescents were divided into two groups: group I consisted of adolescents from high-risk families and group II consisted of adolescents from healthy families.
Results: For total cholesterol (TC), group I presented higher values when compared to group II (153.2 ± 26.5 mg/dL and 138.3 ± 22.0 mg/dL, respectively; $p = 0.001$). For low-density lipoprotein cholesterol (LDL-C), group I had higher values when compared to group II (80.2 ± 24.8 mg/dL and 62.6 ± 12.3 mg/dL, respectively; $p = 0.001$). For high-density lipoprotein cholesterol (HDL-C), group I had lower values when compared to group II (53.8 ± 12.3 mg/dL and 63.9 ± 13.4 mg/dL, respectively; $p = 0.001$). For the values of triglycerides (TG), group I presented higher values when compared to group II (86.98 ± 42.84 mg/dL and 72.50 ± 33.24 mg/dL, respectively; $p = 0.014$). And for fasting plasma glucose, group I had higher values when compared to group II (81.8 ± 13.2 mg/dL and 77.0 ± 9.7 mg/dL, respectively; $p = 0.039$). Systolic blood pressure, diastolic blood pressure, and high-sensitivity C – reactive protein did not differ between groups.
Conclusions: Adolescents from high-risk families had higher basal levels of TC, LDL-C, TG, and fasting plasma glucose and lower basal levels of HDL-C. Whether these findings will influence the development of cardiovascular risk factors or diseases in these subjects should be investigated in future studies.

1. Introduction

Many cardiovascular diseases seen in adults have their origins in childhood. Some cardiovascular risk factors identified in adults are often already present in many children. Fatty streaks, for example, have been found in children as young as 3 years and occur in a progressively greater proportion of children with increasing age. Intimal plaques have been found in adolescents [1]. However, identifying children at an increased risk of developing cardiovascular disease (CVD) as an adult is challenging. Family lifestyle and dynamics have a major influence on the growth and future habits of children, including diet, physical activity, and smoking. As with hypertension, diabetes mellitus, obesity, dyslipidemia, and emotional stress, these habits that develop are considered modifiable risk factors. These risk factors are easily identifiable in the primary care setting [2]. Research is still ongoing about different modifiable factors that may influence CVD development. Lifestyle and health-related behaviors gradually take form beginning in childhood and consolidate before the age of 10 years. Attitude of adults in families play a key role in the development of behavioral risks-factors in their children [3]. The objective of the present study was to identify adolescents from a small community of low socio-economic status that are at risk for developing CVD based on parenteral of risk factors and in to assess of lipid profiles, fasting glucose, high-sensitivity C–reactive protein (hsCRP) and blood pressure.

2. Methods

The present study was conducted in a small community, with around 11,537 inhabitants, attended by only one health center unit facility and one hospital. The human development index (HDI) of the city was 0.601, and the economy was based on agriculture, farming, and trade. There were 300 families registered at the health center facility. Two hundred eight (93.3%) families were contacted and entered at the study. The study included adolescents aged 12–

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19 years of both sexes and their parents. Exclusion criteria were parents that eventually divorced or those that for some reason were not available or refused to participate. No family refused to participate. Two hundred ten families were selected as potential eligible sample; 182 were selected for the study. This corresponds to about 10% of the total local population. The first parent that arrived to the unit followed by its multiple of 3 (third, sixth, ninth, and so on) were randomized for this study. All parents with children between 12 and 19 years were invited to participate in the research, but only one child was randomly selected and participated in the survey. A systematic random sampling was used, and there was a daily average of 50 visits. Both parents and one adolescent were evaluated. The parents were relatively young (mean ages 46.9 ± 7.5 and 42.2 ± 7.6 years for males and females, respectively). The study was approved by the local ethics committee at Pontifical Catholic University. Written informed consent was obtained from all adult patients, and for adolescents parental consent was required. At baseline examination, height, weight, body mass index (BMI), blood pressure, fasting serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), fasting plasma glucose, high-sensitivity C-reactive protein (hsCRP) were measured and information regarding coronary artery disease (CAD), hypertension, diabetes mellitus, smoking habits, physical activity, obesity, dyslipidemia, and eating habits was collected from all families. One hundred eighty-two adolescents (90 male, 15.1 ± 2.2 years) were assessed. The adolescents were divided into two groups according to each risk factor. For TC measures, group I consisted of adolescents whose parents were taking medication for dyslipidemia or had a TC ≥ 200 mg/dL. Group II included adolescents of healthy parents without medication or baseline TC ≤ 200 mg/dL. For LDL-C, group I included adolescents whose parents were taking medication for dyslipidemia or had a baseline LDL-C >130 mg/dL, and group II consisted of adolescents of healthy parents without medication or a baseline LDL-C ≤130 mg/dL. For HDL-C, group I was comprised of adolescents whose parents were taking medication for dyslipidemia or with baseline HDL-C <40 mg/dL, and group II included of adolescents of healthy parents without medication or a baseline HDL-C ≥40 mg/dL. For TG, adolescents were similarly divided: group I with parents on medication for dyslipidemia or with a baseline TGC ≥150 mg/dL, and group II with parents without medication or a baseline TG <150 mg/dL. For glucose, group I parents were taking medication for diabetes mellitus or had a fasting plasma glucose ≥100 mg/dL, and group II included those with healthy parents without medication or a fasting plasma glucose <100 mg/dL. For systolic blood pressure (SBP) groups were divided based on use of medication for hypertension or an SBP > 120 mmHg (group I) and no medication or an SBP ≤ 120 mmHg (group II). For diastolic blood pressure (DBP), group I included parents on antihypertensive agents or with DBP > 80 mmHg, and group II included no medications for hypertension or a DBP ≤ 80 mmHg. The last variable adolescents were grouped by was hsCRP, with group I including parents on medications for hypertension, diabetes, or dyslipidemia and group II including parents no taking medications for these conditions.

2.1. Measurement and classification of cardiovascular risk factors

2.1.1. Blood pressure

All measurements were obtained from non-sedated subjects at rest and in the supine position. Systolic and diastolic blood pressure recordings were taken from the right arm with appropriate sized cuffs following at least 30 min of rest. Three blood pressure measurements were taken using a standard manual mercury sphygmomanometer, and the average of the three readings was used. Blood pressure was classified according to established guidelines [4]: normal (systolic < 120; diastolic < 80 mmHg), prehypertension (systolic 120–139; diastolic 80–89 mmHg), or hypertension (systolic ≥ 140; diastolic ≥ 90 mmHg). Participants who reported taking blood pressure medication were considered to have hypertension regardless of their blood pressure measurements. All the measurements were made by trained medical students.

2.1.2. Lipids

Fasting serum levels of TC, LDL-C, HDL-C, and TG were obtained from all patients (parents and adolescents). Total cholesterol, LDL-C, HDL-C, and TGC values were classified according to Brazilian guidelines for atherosclerosis prevention [4]. Total cholesterol was categorized as optimal (<170 mg/dL) near optimal (171–184 mg/dL), borderline high (185–199 mg/dL), or high (>200 mg/dL). LDL-C was categorized as optimal (<100 mg/dL), near optimal (100–129 mg/dL), borderline high (130–159 mg/dL), or high (≥160 mg/dL). Participants who reported taking cholesterol-lowering medications were considered to have high LDL-C regardless of their measured LDL-C levels. For HDL-C the categories used were low (<40 mg/dL), normal (40–59 mg/dL), or high (≥60 mg/dL). Triglycerides were categorized as normal (<150 mg/dL), borderline high (150–199 mg/dL), or high (≥200 mg/dL).

2.1.3. Glucose

Fasting plasma glucose was obtained from all patients and was categorized as normal (<100 mg/dL), impaired (100–125 mg/dL), or as diabetes (≥126 mg/dL) in accordance with Brazilian guidelines for diagnose and treatment of metabolic syndrome [4]. All participants with physician-diagnosed diabetes were coded positive for diabetes, as were those who reported using insulin or blood glucose-lowering medications.

2.1.4. C–reactive protein

High-sensitivity CRP was obtained from all patients, but the results were not used to classify adolescents. The results for hsCRP are shown in Table.

2.1.5. Other variables

Subjects were considered current smokers if they smoked cigarettes at the time of interview or were previous smokers. Subjects were classified as nonsmokers if they had never smoked. Subjects who engaged in physical activity for <40 min/week were considered sedentary. Those who engaged in physical activity for >60 min/week were considered not sedentary. A family history of CVD was considered positive when there was a first degree relative with diabetes mellitus, coronary artery disease, hypertension, dyslipidemia, peripheral vascular disease, or cerebral vascular disease for men under 55 years and for women under 65 years. Eating habits and consumption of food with cholesterol and saturated hydrogenated fats were assessed with a structured questionnaire.

3. Statistical analysis

Categorical variables were expressed as percentages and continuous variables were expressed as mean ± SD and medians. For quantitative measures, Student's *t*-test was used. Fisher's exact test and chi-square test were used for qualitative or categorical variables. Statistical significance was indicated by a value of $P < 0.05$.

4. Results

The BMI for parents was: 26.31 ± 4.2 kg/m^2 for men and 26.99 ± 5.4 kg/m^2 for women. Waist circumference was: