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Lifestyle behaviors and dyslipidemia in Argentinean native versus urban children

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ABSTRACT

Objective: To determine the prevalence and distribution of dyslipidemia among urban children from Buenos Aires (BA) versus Koya Indian from San Antonio de los Cobres (SAC).

Design and methods: Anthropometric measures, blood pressure, Tanner stages, glucose, lipids and insulin were measured. Dyslipidemia was defined by the NCEP (the National Cholesterol Education Program standards) and AHA (American Heart Association) criteria.

Results: The mean ages were 10.6 ± 3.0 of SAC and 9.5 ± 2.0 years of BA children. Of the 603 BA children, 97 (16.1%) were overweight (OW) and 82 (13.6%) obese (OB), and of 330 SAC, 15 (4.5%) were OW and 12 (3.6%) OB ($p<0.01$). Twenty six percent SAC vs 2.5% BA children ate ≥5 servings/day of fruits and vegetables ($p<0.001$), 30% SAC vs 59% BA children watched TV ≥ 2 h/day($p<0.001$), and 8.2% SAC vs 13.1% BA children skipped breakfast ($p<0.001$). In separate linear regression models, we found that SAC children had a 1.8 mmol/L ($p<0.001$) higher hemoglobin level, a 0.56 mmol/L higher triglyceride level ($p<0.001$), a 0.15 mmol/L higher total cholesterol level ($p=0.001$), a 0.19 mmol/L higher LDL-C level ($p<0.001$), and a 0.33 mmol/L lower HDL-C level ($p<0.001$) than BA children adjusted for confounding factors.

Conclusion: Koya children have a higher risk for dyslipidemia in comparison with BA children, even after controlling for lifestyle behaviors, obesity, age, and sex , suggesting that dyslipidemia could be related to their genetic backgrounds.

Introduction

Obesity is generally recognized as an increasingly important cause of childhood morbidity worldwide and is a contributor to chronic diseases such as type 2 diabetes and cardiovascular disease (CVD) [1,2]. Behavioral factors such as poor dietary habits, a sedentary lifestyle, and a social environment which encourages unhealthy behaviors are closely related to the prevalence of obesity and metabolic syndrome in adolescents [3]. Type 2 diabetes has reached epidemic proportions in certain populations such as the Nauru Indian [4], the Aborigines of Australia [5], and the American-Indian groups in the U.S. [6]. In addition, studies have shown [4] a lower BMI among Indian populations compared to urbanized populations, and their traditional diets and lifestyle are not commonly associated with obesity. This study was performed in San Antonio de los Cobres (SAC), a small town located in Salta Province, northwestern Argentina [7]. Most of the population are Koya Indian [7]. SAC is a town with a population of 4274 inhabitants (~500 children), located in a remote mountainous region only recently accessible by road and isolated from urbanization and economic development [11]. The town is known for its high elevation of approximately 3750 m (2.34 miles) above sea level, and is one of the highest inhabited elevations in Argentina [7]. Most of the men work in mines while the women practice animal husbandry (lamb and llama) [11]. Koya children from all four schools in SAC were evaluated in May 2011.

Abnormal lipid levels often emerge during childhood and adolescence [8]. Given that longitudinal studies have demonstrated that dyslipidemia during childhood often persists into adulthood [9] and is associated with atherosclerosis [10], there is an increasing focus on lipid level screening and intervention. We are unaware of any previous studies comparing the prevalence of abnormal lipid levels in a group of urban children versus Koya Indian children from SAC. The objective of this study was to determine the prevalence and distribution of dyslipidemia among urban children from Buenos Aires (BA) versus Koya children from SAC.

Methods

Numerous studies have been performed to determine the prevalence of abnormal lipid levels in children, but only a limited number of studies have been done in non-Caucasian groups such as Argentinean Indians. Exclusion criteria included: any of the five components of metabolic

Abbreviations: OW, overweight; OB, obesity; WC, waist circumference; BA, Buenos Aires; SAC, San Antonio de los Cobres; CVD, cardiovascular disease.

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syndrome not being measured; not fasting for at least 12 h; the presence of diabetes or other chronic disease; using medication that would affect blood pressure, glucose or lipid metabolism, and the informed consent form not being signed. The study was approved by the Human Rights Committee of the Salta Health Ministry. Each parent and subject gave written informed consent after an explanation of the study and before its initiation. Data collectors included a team of trained technicians, a physician, and laboratory personnel from the University of Buenos Aires. Anthropometric measures were performed in all the school children (~500) [7,11]. Due to financial restrictions, we offered free testing to only 362 SAC children. There was not a significant difference in age, BMI, gender, or socioeconomic class between all the school children and those who underwent testing. Thirty participants were also excluded because at least one of the components of metabolic syndrome was not assessed, and two participants were excluded because the informed consent form was not signed. Therefore, 330 SAC children (147 males) with an age range of 5 to 19 years participated in the survey. The sample size represented 2/3 of the total population and was randomly selected, which ensured an error less than 0.01 with 95% confidence, even in smaller proportions.

Anthropometric measures were performed in all the school children. Due to financial restrictions, we offered free testing to only 362 SAC children. There was not a significant difference in age, BMI, gender, or socioeconomic class among all the school children and those who underwent testing. Thirty participants were also excluded because at least one of the components of metabolic syndrome was not assessed, and two participants were excluded because the informed consent form was not signed. Therefore, 330 SAC children (147 males) with an age range of 5 to 19 years participated in the survey. The SAC children were compared to 603 BA children (316 males) in a cross-sectional study. Schools from the BA suburbs were randomly selected between April and September 2007 and 2008 as previously described [12]. The BA children belonged to a mixed population composed of approximately 85% of European descent (largely Spanish and Italian), with the remainder of mixed European and American Indian (12%) or American Indian (3%) descent [12]. In contrast 98% of the SAC population were Koya Indian [7]. Validated questionnaires for lifestyle behaviors and socioeconomic level were completed by the same pediatrician as previously described [13].

The children' s height, weight and waist circumference were measured as previously described [12] Children were classified as normal weight (<85th percentile), overweight (OW) (85th to <95th percentile), or obese (OB) (≥95th percentile) according to the Center for Disease Control norms [14]. BMI z-score (BMI-z) was also determined [14]. The physical examination included the determination of the stage of puberty according to the criteria of Tanner stages [15]. Pubertal stages were determined in almost all of the children except in 9/330 SAC children and 30/603 BA children who refused to be examined.

Three separate blood pressure measurements were recorded by a trained technician using a random-zero sphygmomanometer after the participant was seated at rest for 5 min [16]. The averages of the last 2 measurements of systolic and diastolic blood pressures were used. Hypertension was defined as BP > 90th percentile for age, gender, and height according to the standards of the National Heart, Lung and Blood Institute [16].

Blood samples were obtained from subjects after a 12-hour overnight fast for the measurement of hemoglobin, glucose, insulin and lipid concentrations. Plasma glucose and lipid levels were assessed using standardized techniques (Roche Diagnostics, Mannheim, Germany) such as a Hitachi 917 analyzer (Hitachi High Technologies Corp., Tokyo, Japan). Plasma insulin levels were measured by radioimmunoassay (Linco Laboratories, St. Charles, MO, USA). All samples were analyzed in a single laboratory. We used a standardized homogeneous assay for HDL-C, with no differences in the generation assays between measurements for the two populations. The calibrators used were the same and there were no changes in the assigned calibrator values from the manufacturer over time between the studies. Factors in the calculation from the instruments were not used. We used the same lot of internal control materials in order to check long term bias and imprecision. All the monthly values were within acceptable values.

Lipid abnormalities were defined according the reference standards from the NCEP (the National Cholesterol Education Program standards) guidelines, which are ≥5.18 mmol/L for total cholesterol and ≥3.37 mmol/L for low-density lipoprotein cholesterol (LDL-C) [17]. The AHA (American Heart Association) has recommended that triglyceride concentrations of ≥1.69 mmol/L and high-density lipoprotein cholesterol (HDL-C) ≤ 0.91 mmol/L be considered abnormal for children [18]. Metabolic syndrome was defined according to the criteria of Cook et al. [2].

Data analysis

Chi squared test was used to compare proportions. When more than 20% of the cells had expected frequencies < 5, Fisher's exact test was used. Data distribution was assessed using the Shapiro–Wilks test. When comparing two groups with normally distributed data, a student *t* test was performed. Univariate analyses were performed using Kendal or Spearman coefficients depending on the variables used in each case. Multiple linear regression analysis was performed to examine the relationship between lipid levels and other variables, such as age, gender, BMI, location, socio-economic class and lifestyle behaviors.

Values of $P < 0.05$ were considered significant. Bonferroni's adjustment was carried out when numerous comparisons were performed. Data are presented as mean ± SD or as median (Quartile I–Quartile III). Analyses were done using the SPSS® (Chicago, IL) statistical software package SPSS version 17.0.

Results

Characteristics of the sample: pubertal stages and socioeconomic class

We examined 330 Koya Indian school children (147 males) aged 10.6 ± 3.0 years and 603 urban mixed population school children (316 males) aged 9.5 ± 2.0 years from a cross-sectional study. All participants came from a low socio-economic background. Approximately 88% of the SAC parents versus 68% of the BA parents had only an elementary school education or less. There was a higher prevalence ($p < 0.01$) of families who did not have a refrigerator in SAC (32%) than in BA (8%). Furthermore, the percentage of families who had a dirt floor was significantly higher in SAC (31%) than in BA (5.5%). Therefore, the socio-economic level of children from the SAC group was substantially lower than that of the BA group.

The prevalence of Tanner 1 (pre-pubertal) was significantly ($p < 0.001$) lower in SAC children (44%; 141/321) than in BA children (60%; 346/573) as expected, since SAC children in the study were older than BA children (Table 1).

Analysis of data according to lifestyle behavior

The reported median daily intake of sweet beverages was 2 glasses/day (quartile I: 2–quartile III: 3) in SAC children versus 4 glasses/day (2–5) in BA children ($p < 0.001$), the median intake of fruit and vegetables 4 servings/day (2–4) in SAC children versus 1 serving/day (2–3) ($p < 0.001$) in BA children, and the hours of TV watched was 2 h/day (1–3) in SAC children versus 3 h/day (2–4) ($p < 0.001$) in BA children. The median intake of meat was the same in both communities; 7 servings/week (5–7).

Approximately 49% of SAC children vs 72% of BA children drank two or more glasses of sweet beverages per day ($p < 0.001$); 26% of SAC children vs 2.5% of BA children ate five or more servings of fruits and vegetables per day($p < 0.001$); 30% of SAC children vs 59% of BA children watched TV more than 2 h per day($p < 0.001$); and 8.2% of