Journal of Clinical Lipidology (2016) 10, 378–385

Journal of Clinical Lipidology

Distribution and correlates of non–high-density lipoprotein cholesterol and triglycerides in Lebanese school children

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KEYWORDS:
Non-HDL-Cholesterol;
Triglycerides;
School children;
Lebanese

BACKGROUND: The prevalence of dyslipidelmia in pediatric Middle-Eastern populations is unknown. Our study aims to investigate the distribution and correlates of non–high-density lipoprotein cholesterol (non-HDL-C) and triglycerides among Lebanese school children.

METHODS: A total of 969 subjects aged 8–18 years were included in the study (505 boys and 464 girls). Recruitment was done from 10 schools located in the Great Beirut and Mount-Lebanon areas. Non-fasting total cholesterol, triglycerides, and HDL-cholesterol (HDL-C) were measured. Non-HDL-C was calculated. Schools were categorized into 3 socioeconomic statuses (SESs; low, middle, and high).

RESULTS: In the overall population, the prevalence of high non-HDL-C (>3.8 mmol/L), very high non-HDL-C (>4.9 mmol/L), and high triglycerides (>1.5 mmol/l) are respectively 9.2%, 1.24%, and 26.6%. There is no significant gender difference for non-HDL-C or triglycerides. Non-HDL-C and triglycerides are inversely correlated with age in girls ($P < .0001$ for both variables) but not in boys. They are also positively correlated with body mass index (BMI) in boys and girls ($P < .0001$ for all variables). There is no relationship between schools' socioeconomic process (SES) and non-HDL-C. However, triglycerides are higher in children from lower SES schools. After adjustment for age and body mass index (BMI), testosterone is inversely associated with triglycerides in boys ($P < .0001$). In a multivariate regression analysis, non-HDL-C is independently associated with age and BMI in girls ($P < .0001$ for both variables) but only with BMI in boys ($P < .0001$), whereas triglycerides are independently associated with BMI and schools' SES in both girls and boys.

CONCLUSIONS: This study confirms, in our population, the association between obesity and both high non-HDL-C and triglycerides, and between high triglycerides and low SES.

This work was supported by a grant of the "Conseil de recherche de l'Université Saint-Joseph" FM258, Beirut.

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Submitted October 12, 2015. Accepted for publication December 21, 2015.

Introduction

Pediatric dyslipidemia contributes to early atherosclerosis and subsequently to early cardiovascular disease.[1] Traditionally, screening recommendations of childhood hypercholesterolemia[2–4] target only a specific group of

1933-2874/
http://dx.doi.org/10.1016/j.jacl.2015.12.018

children with a history of familial hypercholesterolemia (FH). However, recently, the Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents concluded that early identification and control of dyslipidemia throughout youth would substantially reduce clinical cardiovascular disease risk beginning in young adult life.[1] This panel, sponsored by the United States National Heart Lung and Blood Institute (NHLBI),[1] recommended a universal screening with nonfasting non-HDL-C (determined by subtracting HDL-C from total cholesterol [TC]), starting at ages 9–11 years and again between ages 17–21 years, and this would be the first step in identifying children and adolescents with lipid disorders.[1] In 2014, these recommendations were subsequently endorsed by the American Academy of Pediatrics.[5]

Because non-HDL-C is a combined measure of the cholesterol content of all atherogenic apolipoprotein B–containing lipoproteins and is not influenced by postprandial trigycerides,[6] its measurement was proposed at first step. Non-HDL-C was also considered as good as or better than other lipid measures, including LDL-C, in predicting adult dyslipidemia and subclinical atherosclerosis.[7,8] In addition, because the difference between fasting and nonfasting triglyceride levels is minimal[9] a nonfasting measurement of triglycerides could be reliable.

In the recent National Health and Nutrition Examination Surveys (NHANES) study,[10] the prevalence of high non-HDL-C (>3.8 mmol/l) was respectively 11.8% and 15.0% for the age groups 9–11 years and 17–19 years. Non-HDL-C varied significantly with race and/or ethnicity and overweight and/or obesity status in the 7058 participants aged 6–19 years. On the other hand, a recent Saudi study showed that this prevalence is 20.8% among Arab adolescents.[11] In Lebanon, a Middle Eastern country where dyslipidemia is very common in the adult population, and where FH seems to be much more common compared to the worldwide prevalence,[12,13] few studies were done to determine the prevalence of abnormal lipid parameters. These studies were performed only on the adult population either with a single-cholesterol measurement[14] or on a selected subgroup of the population (hospital employees).[15]

On the other hand, the association between sex steroids and lipid parameters in children and adolescents is not well documented and subject of controversy.[16–18] Testosterone is associated with lower HDL-C in male adolescents aged 10–15 years[16] whereas, at the opposite, it is associated with increased HDL-C levels among prepubertal boys.[17] In addition, in pubertal boys, sex hormone-binding globulin but not testosterone was related to decrease in HDL-C and triglycerides.[18]

The aim of our study is to determine the prevalence of dyslipidemia in Lebanese school children and to look at the relation between lipid parameters and age, sex, body mass index (BMI), schools' socioeconomic status (SES), and testosterone levels in boys.

Methods

Population

In this cross-sectional study, 10 private and public schools were targeted for recruitment using a randomized stratified sampling. The schools were selected from the areas of Great Beirut and Mount Lebanon, both areas concentrating most Lebanese population. Recruitment was done between May 2013 and October 2014. Schools were categorized as high, middle, or low socioeconomic status (SES) depending on the yearly school fees (respectively for group 1 between $5000 and $7000; for group 2 between $3000 and $5000; and for group 3 between $1000 than $3000 or free, the last group corresponding to public or semipublic schools). Children with any acute or chronic medical condition (more particularly diabetes or hypothyroidism), those under medication that may affect the lipid profile (contraceptive pills, isotretinoin, oral corticosteroids, atypical antipsychotics, or immunosuppressive therapies) as well as nonconsenting children were excluded from the study. A written informed consent was signed by the parents. The protocol was approved by our hospital ethics committee (CEHDF449).

The day of sampling, all participants had their height and weight measured using the same device. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). To account for variability by age and sex, all BMI measures were compared with age-specific and sex-specific reference values from the 2000 CDC growth charts to define weight status.[19] This comparison was chosen because of the lack of reference values in Lebanon. Normal weight was defined as a BMI-for-age-sex of <85th percentile, overweight as a BMI-for-age-sex of the 85th to <95th percentile, and obesity as a BMI-for-age-sex of ≥95th percentile.[19] The population was categorized into 3 age groups: 8–11 years, 12–14 years and 15–18 years.

Laboratory analysis

Nonfasting sampling was performed on all subjects in the schools between 8 and 10 AM. For girls, the sampling was performed any day during the menstrual cycle. Blood specimens were then centrifuged the day of sampling and the serum subsequently frozen at −20°C for a period of <2 months. Measurement of TC, HDL-C, and triglycerides was performed by a Vitros 5.1 FS automate (Ortho-Clinical Dignostics, Inc. Raritan, NJ). The non-HDL-C was calculated by subtracting HDL-C from TC. As no normative data are present for Middle Eastern populations, data were compared to the United States standards. Results were divided into 3 groups as recommended by the NHLBI[1]: the abnormal group was defined as TC >5.2 mmol/L, non-HDL-C >3.8 mmol/L, triglycerides >1.5 mmol/L, and HDL-C <1 mmol/L; the borderline one as TC ≥4.4 and