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Adolescent and adult African Americans have similar metabolic dyslipidemia

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BACKGROUND: African Americans (AAs) have lower triglyceride (TG) and higher high-density lipoprotein cholesterol (HDL-C) than other ethnic groups; yet, they also have higher risk for developing diabetes mellitus despite the strong relationship of dyslipidemia with insulin resistance. No studies directly compare adolescents and adults with regard to relationships among dyslipidemia, high-sensitivity C-reactive protein (hs-CRP), and insulin resistance. Here, we compare AA adolescents to adults with regard to the relationships of adiposity-related lipid risk markers (TG-to-HDL ratio and non–HDL-C) with body mass index (BMI), waist circumference (WC), homeostasis model of insulin resistance (HOMA), and hs-CRP.

METHODS: Two cohorts of healthy AA were recruited from the same urban community. Participants in each cohort were stratified by TG-to-HDL ratio (based on adult tertiles) and non–HDL-C levels. BMI, WC, HOMA, and hs-CRP were compared in adolescents and adults in the low-, middle-, and high-lipid strata.

RESULTS: Prevalence of TG-to-HDL ratio greater than 2.028 (high group) was 16% (44 of 283) in adolescents and 33% (161 of 484) in adults; prevalence of non–HDL-C above 145 and 160, respectively, was 8% (22 of 283) in adolescents and 12% (60 of 484) in adults. Values of hs-CRP were lower, and HOMA values were higher in adolescents (both $P < .01$). As both TG-to-HDL ratio and non–HDL-C strata increased, BMI, WC, HOMA, and hs-CRP increased in both adolescents and adults. In the high TG-to-HDL ratio and non–HDL-C groups, BMI and WC were similar in adolescents vs adults (BMI, 34 kg/m^2 vs 32 kg/m^2; WC, 101 cm vs 101 cm). After adjusting for non–HDL-C and other covariates, a 2-fold increase in TG-to-HDL ratio was associated with increases of 10.4% in hs-CRP (95% CI, 1.1%–20.5%) and 24.2% in HOMA (95% CI, 16.4%–32.6%). Non–HDL-C was not significant in models having TG-to-HDL ratio.

CONCLUSION: The elevated TG-to-HDL ratio is associated with similar inflammation and metabolic risk relationships in adolescent and adult AAs.

Introduction

Obesity, dyslipidemia, insulin resistance, and inflammatory markers such as high-sensitivity C-reactive protein (hs-CRP) are strongly associated and together increase risk for metabolic and cardiovascular diseases. Elevated serum triglyceride (TG) and serum lower high-density lipoprotein (HDL) are associated with measures of insulin resistance,

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and both lipid measures are components of metabolic syndrome.[1] The TG-to-HDL ratio has been shown to be a strong marker for cardiovascular risk and metabolic syndrome in obese children and adults.[2–6] Non–HDL cholesterol (non–HDL-C) has also been shown to be strongly associated with the metabolic syndrome in children and reflects the concentration of atherogenic lipoproteins.[5,7] Non–HDL-C is reported to be the best predictor of adult dyslipidemia and other cardiovascular risks.[8,9] Insulin resistance is commonly associated with obesity in children and adolescents and has been shown to lead to decreased clearance of TG and low-density lipoprotein (LDL), overproduction of very low–density lipoprotein, and therefore decreased production of HDL.[10–12] However, direct comparisons between adults and children to determine if there is a difference in the magnitude of association with regard to these traits across the life span has not been previously studied.

Health-related disparities have been identified in adult ethnic minority populations including African Americans (AAs).[13,14] Ethnic differences in cardiovascular disease outcomes are apparent and important to consider. Compared with Caucasians, AA adults suffer higher rates of obesity and diabetes with disproportionally greater rates of the premature cardiovascular morbidity and mortality. The Bogalusa Heart Study, which enrolled AA and Caucasian youth, demonstrated that many metabolic parameters, such as obesity, high blood pressure (BP), and lipid abnormalities tracked from childhood into adulthood. Although the trends were the same for AAs and Caucasians, there was a higher prevalence of these risk factors in AAs.[15,16] Associations of elevated TG and low HDL-C exist among both ethnic groups, but the magnitude is different from one ethnic group to another. AAs have lower TG and higher HDL-C levels, compared with their Caucasian counterparts, and this is observed in both children and adults.[6,17,18] Nonetheless, AA girls are observed to have higher body mass index (BMI) and greater insulin resistance compared with Caucasian girls of the same age.[19] Despite higher prevalence of insulin resistance, the phenotype of hypertriglyceridemia and low HDL-C is observed less frequently in AAs of all ages.[17]

Because TG-to-HDL ratio and non–HDL-C are strongly associated with insulin resistance and inflammation, we stratified adolescent and adult AAs by these measures to determine if associations with BMI, waist circumference (WC), hs-CRP, and the homeostasis model of insulin resistance (HOMA) were similar in the 2 age groups. These comparisons will inform discussions about metabolic risk across the life span.

Methods

Cohort

Adolescent and adult studies enrolled AAs (based on self-report) from the same urban community. The adolescent study enrolled participants between ages 13 and 18 years of age from 2009 to 2011. The adolescent study enrolled participants for a study designed to compare those with and without high BP (>120/80 mm Hg) and with and without obesity (defined as BMI >95th percentile) in a 2 × 2 design.[20] The adolescents were recruited from primary care pediatrics and family practices at Thomas Jefferson University and from community primary care practices. Exclusion criteria for adolescent participants were known diabetes, secondary hypertension, stage 2 hypertension, renal disease, and other chronic diseases. This study protocol was approved by the Institutional Review Board of Thomas Jefferson University and the A.I. DuPont Hospital for Children. Written and informed consent was obtained from those 18 years old. Parent or guardian informed consent was obtained for adolescents under age 18 years.

Adults were between the ages 19 and 45 years, recruited from family practices at Thomas Jefferson University and from community primary care practices, and data were collected between 2006 and 2010. All the participants were without chronic health problems with the exception of elevated BP (>130/85 mm Hg) or receiving antihypertensive medication in approximately half the participants and obesity in half of the participants. Individuals with known diabetes or other chronic diseases were excluded from the adult study. The study protocol was approved by the Institutional Review Board of Thomas Jefferson University. Written informed consent was obtained from each participant at the time of the enrollment.

Study methods

Similar methods and procedures were applied to both adolescent and adult studies. These methods have been published in other reports.[20,21] Data on health status, medication use, and health-related behaviors were obtained by self-report. Clinical assessment included BP and anthropometric measurements (height, weight, and WC). BMI was calculated (weight in kilograms divided by height in meters squared). For the adolescent cohort, obesity was defined as BMI as >95th percentile by Centers for Disease Control criteria (http://www.cdc.gov/obesity/childhood/defining.html).

A fasting blood sample was obtained for glucose, insulin, lipids, and hs-CRP. Glucose was measured by the glucose oxidase technique (YS model 27; Glucostat, Yellow Springs, OH). Samples of fasting plasma were stored frozen (−80°C) for later assay of insulin and hs-CRP. Plasma insulin concentration was assayed using a solid phase radioimmunoassay (Coat-a-Count; Diagnostic Products Corp, Los Angeles, CA). Assay for hs-CRP was performed using an ELISA kit from R&D Systems (Minneapolis, MN). Insulin resistance was estimated using HOMA.[22] Fasting lipids were measured including TG, HDL-C, and total cholesterol with LDL-C calculated. Lipids were measured using the Hitachi 704 standard