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Original Article

Ethnic differences in plasma lipid levels in a large multiethnic cohort: The HELIUS study

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BACKGROUND: There is limited information on differences in plasma lipid levels among the major ethnic groups in Europe.

OBJECTIVE: We investigated ethnic differences in plasma lipid levels in a large multiethnic cohort and explored the contribution of obesity and other determinants to ethnic differences in low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglyceride (TG) levels.

METHODS: We compared lipid profiles among 21,617 participants (aged 18 to 70 years) of Moroccan, Ghanaian, South Asian Surinamese, African Surinamese, Turkish and Dutch ethnic origin, living in Amsterdam, the Netherlands. Fasting total cholesterol, HDL-C, and TG were measured while fasting. LDL-C was calculated using the Friedewald formula and corrected for lipid-lowering therapy.

RESULTS: Mean LDL-C ranged from 2.84 ± 0.22 mmol/L in Moroccans to 3.13 ± 0.06 mmol/L in South Asian Surinamese participants. Mean HDL-C ranged from 1.30 ± 0.15 mmol/L in Turkish to 1.62 ± 0.10 mmol/L in Ghanaian participants. Mean TG ranged from 0.64 ± 1.18 mmol/L in Ghanaian to 1.00 ± 1.18 mmol/L in South Asian Surinamese and 1.00 ± 1.27 mmol/L in Turkish origin participants. The differences in LDL-C, HDL-C, and TG levels remained present after adjustment for age and sex. Differences between ethnic groups were significantly attenuated after adjustment for other determinants, including body mass index, diabetes and use of lipid-lowering drugs but remained significant.

CONCLUSION: Large ethnic differences exist in lipid components, especially HDL-C and TG levels with a higher HDL-C and lower TG levels among African (Ghanaian and Surinamese) origin participants and the most unfavorable lipid profiles among individuals of South Asian Surinamese and Turkish origin.

Introduction

The prevalence of cardiovascular disease (CVD) varies significantly in different parts of the world.[1–7] This is in part due to differences in the relative distribution of CVD risk factors among various ethnic groups, including differences in plasma lipid levels.[2,8–11] These differences may

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relate to lifestyle factors such as obesity, diabetes, and smoking but also to (epi)genetic mechanisms. For example, even among children aged 5–6 years, lipid levels have been shown to differ among ethnic groups,[12,13] suggesting an important role for (epi)genetic factors[13] and gene-environment interactions.[14–16] Most of the data are derived from comparisons between studies conducted in the United States, whereas limited information is available on ethnic minority groups in Europe.[17,18]

In the present study, we evaluated ethnic differences in lipid profile using a large, population-based cohort study among subjects aged between 18 and 70 years old living in Amsterdam, the Netherlands, representing the six largest ethnic migrant groups in Europe from outside the European Union.

Material and methods

Study population

This study is based on baseline data from the HEalthy Life In an Urban Setting (HELIUS) study. Aims, design, and methods of this study have been previously described.[19] In brief, HELIUS is a large-scale prospective cohort study on health and health care utilization among different ethnic groups living in Amsterdam. Baseline data collection was carried out by the Academic Medical Center and the Public Health Service of Amsterdam from 2011 until 2015. Subjects aged between 18 and 70 years old from different ethnic groups living in Amsterdam (African Surinamese, South Asian Surinamese, Turkish, Moroccan, Ghanaian, and Dutch origin) were included. Participants were randomly sampled from the municipal registers, stratified by ethnicity. Data were collected by questionnaire and physical examination. During the physical examination, fasting venous blood was drawn for laboratory analysis. The HELIUS study is conducted in accordance with the Declaration of Helsinki after approval by the Academic Medical Center Ethical Review Board. All participants provided written informed consent.

For the present analysis, we used data of 21,617 participants with complete data from six ethnic groups (3043 South Asian Surinamese, 4151 African Surinamese, 2339 Ghanaian, 3906 Moroccan, 3614 Turkish, and 4564 Dutch participants). We excluded participants of Javanese Surinamese (n = 233), other/unknown Surinamese (n = 267), and other/unknown ethnic origin (n = 48) because of the limited group size.

Ethnicity

Participant's ethnicity was defined according to the country of birth of the participant, as well as the one of his/her parents. In particular, a subject is considered as of non-Dutch ethnic origin if he/she fulfills either of the following criteria: (1) he or she was born abroad and has at least one parent born abroad (first generation) or (2) he or she was born in the Netherlands but both his/her parents were born abroad (second generation).[20] Of the Surinamese immigrants in the Netherlands, approximately 80% are of either African or South Asian origin. Surinamese subgroups were classified according to self-reported ethnic origin. Participants were considered of Dutch origin if the subject and both parents were born in the Netherlands.

Laboratory measures

Blood samples were drawn in fasting state (at least 8 hours) and plasma samples were used to measure concentrations of total cholesterol, triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C) by colorimetric spectrophotometry (Roche Diagnostics, Japan) and glucose by spectrophotometry, using hexokinase as primary enzyme (Roche Diagnostics, Japan). Low-density lipoprotein cholesterol (LDL-C) was calculated according to the Friedewald formula.[21] LDL-C values could not be calculated for 88 subjects with TG levels above 4.5 mmol/L and were considered as missing. Whole blood was used to determine the concentration of hemoglobin A1c by high-performance liquid chromatography (TOSOH, Japan).

Additional variables

Information on migration history (age of migration, residence duration in the Netherlands), educational level (low/high), smoking (yes/no), alcohol assumption (yes/no), physical activity (min/wk), and medical history was obtained by questionnaire. Educational level was assessed through the participant's highest level of education obtained (either in the Netherlands or in the country of origin) and categorized into low education (never been to school, elementary schooling, lower vocational schooling, lower secondary schooling) or high education (intermediate/higher vocational schooling, intermediate/higher secondary schooling, university). Physical activity (min/wk) was assessed with the short questionnaire to assess health-enhancing physical activity questionnaire and included activities related to occupation, leisure time, household, transportation means, and other daily activities;[22] participants were then categorized as achieving the Dutch norm for healthy physical activity (>=5 times a week 30 minutes moderate intensive activity) or not. Coronary artery disease (CAD) was self-reported and defined as a history of chest pains lasting ≥30 minutes, coronary angioplasty, or bypass operation. Stroke was defined as self-reported history of cerebral infarction or cerebral hemorrhage.

Weight and height were measured in duplicate in barefoot subjects wearing light clothes only. Waist circumference was measured in duplicate using a tape measure at the level midway between the lowest rib margin and the iliac crest, and hip circumference was measured in duplicate at the widest level over the trochanter major. Body mass index (BMI) was calculated as weight (kg) divided by height