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Urbanization, mainly rurality, but not altitude is associated with dyslipidemia profiles

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BACKGROUND: Geographical and environmental features such as urbanization and altitude may influence individual's lipid profiles because of the diversity of human-environment interactions including lifestyles.

OBJECTIVE: To characterize the association between altitude and urbanization and lipid profile among Peruvian adults aged ≥35 years.

METHODS: Cross-sectional analysis of the CRONICAS Cohort Study. The outcomes of interest were 6 dyslipidemia traits: hypertriglyceridemia, high low-density lipoprotein cholesterol, low high-density lipoprotein cholesterol (HDL-c), nonisolated low HDL-c, isolated low HDL-c, and high non-HDL-c. The exposures of interest were urbanization level (highly urban, urban, semi-urban, and rural) and altitude (high altitude vs sea level). Prevalence ratios (PRs) and 95% confidence intervals (95% CIs) were calculated using Poisson regression models with robust variance adjusting for potential confounders.

RESULTS: Data from 3037 individuals, 48.5% males, mean age of 55.6 (standard deviation ±12.7) years, were analyzed. The most common dyslipidemia pattern was high non-HDL-c with a prevalence of

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88.0% (95% CI: 84.9%–90.7%) in the rural area and 96.0% (95% CI: 94.5%–97.1%) in the semi-urban area. Relative to the highly urban area, living in rural areas was associated with a lower prevalence of hypertriglyceridemia (PR = 0.75; 95% CI: 0.56–0.99) and high non-HDL-c (PR = 0.96; 95% CI: 0.93–0.99), whereas living in semi-urban areas was associated with higher prevalence high low-density lipoprotein cholesterol (PR = 1.37; 95% CI: 1.11–1.67). Compared with sea level areas, high-altitude areas had lower prevalence of high non-HDL-c (PR = 0.97; 95% CI: 0.95–0.99).

CONCLUSION: Urbanization but not altitude was associated to several dyslipidemia traits, with the exception of high non-HDL-c in high altitude settings.

Introduction

Although cardiovascular diseases (CVDs) continue being the leading cause of death worldwide, the prevalence of dyslipidemia–the key underlying process contributing to most CVD–continues increasing worldwide.[1] Indeed, high prevalence of dyslipidemia has been reported in low- and middle-income countries, especially in Latin America, such as 57% of individuals with low levels of high-density lipoprotein cholesterol (HDL-c) in Lima, 32% of hypertriglyceridemia (high triglyceride [TG]) in Mexico city, and 24% of high low-density lipoprotein-cholesterol (LDL-c) levels in Buenos Aires.[2]

Levels of serum lipids are influenced by several environmental factors. For instance, fatty acid and carbohydrate content and composition in diet, adiposity, physical activity, and alcohol intake have been shown to be important determinants of lipoprotein secretion and metabolism.[3] However, the role of environmental factors directly related to the place of residence, such as urbanization or altitude, has not been fully understood.

The potential association between high altitude and dyslipidemia remains controversial. Some studies in Peru have found a positive association between high altitude with hypertriglyceridemia and low HDL-c.[4,5] Also, a study conducted in Lhasa, Tibet, located at 3660 meters above sea level (m.a.s.l.), found a high prevalence of hypertriglyceridemia and low concentrations of HDL-c.[6] On the other hand, one study in Peru reported a low prevalence of hypercholesterolemia, hypertriglyceridemia, and low HDL-c in high altitude (>3000 m.a.s.l.) compared with sea level population.[7] Another study in Arab populations found higher levels of HDL-c in people who live at 2000 m.a.s.l. relative to those who live at sea level.[8] These studies denote that the controversial results in the association between high altitude and dyslipidemia patterns and does not account for the rural/urban effect that is also be present even at different altitudes.

Studying the isolated effect of high altitude and urbanization on lipid levels is challenging, as both are strongly associated with different lifestyle behaviors compared with sea level and rural counterparts, respectively. For example, lifestyle in rural areas includes a dietary intake characterized by high levels of carbohydrates[9,10] and greater levels of physical activity compared with urban areas.[11] Understanding the diversity of human-environment interactions with regard to dyslipidemias is important, especially if in 2014, 88% of Latin America and Caribbean population lived in urban areas,[12] and it is calculated that 35 million people live above 2500 m.a.s.l in South America between the cities of Bolivia, Colombia, Ecuador, and Peru.[13] Also, between 10 and 17 million people live at over 2500 m.a.s.l. in the Andes.[14]

Previous studies in dyslipidemias were predominantly conducted in rural areas in high-altitude or urban sea level cities. The CRONICAS Cohort Study was designed to evaluate Peruvian adults from 4 settings differing on the levels of altitude and urbanization, allowing for combinations of rural-urban and sea level-high altitude settings. As such, it offers a unique opportunity to test our hypothesis and characterize the association between altitude and urbanization and lipid profiles.

Methods

Study design, settings, and participants

Baseline information from the CRONICAS Cohort Study, collected in 2010-2011, was analyzed in the present study. The CRONICAS Cohort Study was conducted in 4 different settings: Pampas de San Juan de Miraflores, a highly urbanized community of approximately 15,000 inhabitants/km^2 and located within Lima, the capital city of Peru, at sea level. Tumbes, a semi-urban site with 250 inhabitants/km^2 is located in the northern coast of Peru, also at sea level. Puno, the high-altitude site, is located on the shore of Lake Titicaca at 3825 m.a.s.l. and contributed with an urban site and a rural site with population densities of 9940 inhabitants/km^2 and 31 inhabitants/km^2, respectively.[15] (Fig. 1).

All participants were ≥35 years, full-time residents in the study area, and provided informed consent. Participants were excluded if they were pregnant, had any