Atherosclerosis 223 (2012) 512–518

Contents lists available at SciVerse ScienceDirect

Atherosclerosis

journal homepage: www.elsevier.com/locate/atherosclerosis

Prevalence of dyslipidemia and associated factors in the Yi farmers and migrants of southwestern China

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ARTICLE INFO

Article history:
Received 12 December 2011
Received in revised form
21 May 2012
Accepted 4 June 2012
Available online 18 June 2012

Keywords:
Dyslipidemia
Prevalence
Ethnic Yi
Emigration
Risk factors

ABSTRACT

There are scant data on serum lipid profile in the Yi people in China. The Yi farmers and migrants provide an unusual opportunity to estimate effects of environmental factors on serum lipid levels. We conducted a cross-sectional study in the Yi people to estimate prevalence of dyslipidemia and associated factors. It was found that prevalence of high total cholesterol (TC), triglyceride (TG), low-density lipoprotein-cholesterol (LDL-C), abnormal ratio of TC/HDL-C and low high-density lipoprotein-cholesterol (HDL-C) were 1.82%, 5.07%, 1.56%, 9.30% and 39.47%, respectively in the Yi farmers. And those in the Yi migrants were 4.81%, 22.21%, 3.24%, 26.56% and 40.53%. Prevalence of dyslipidemia increased with time period in the Yi farmers after their emigrating to urban areas for less than 25 years, except high TC. It was also found that prevalence of dyslipidemia of the Yi migrants increased with time period before their emigration, including hypertriglyceridemia, low HDL-C and high ratio of TC/HDL-C. Their body mass index (BMI), history of type 2 diabetes mellitus (T2DM), gender, ever alcohol drinking and physical activity all were associated with dyslipidemia, but no factors associated with high LDL-C was found. In conclusion, all these results suggest that the Yi migrants have a higher prevalence of dyslipidemia than the Yi farmers do, which possibly can attribute to their urbanized lifestyles.

1. Introduction

According to the World Health Organization (WHO), up to 75 percent of all deaths in developing nations will be caused by non-communicable disease in 2020. The WHO predicts that chronic diseases, coronary artery disease (CAD) in particular, will top the list as the most frequent cause of deaths in the third world. CAD, thus, is now being considered an important public health problem not only in developed countries but also in developing countries like China. With rapid socioeconomic development, emergence of a cardiovascular disease (CVD) epidemic has been observed in developing countries during recent decades [1]. In China, CVD accounted for nearly 40 percent of all deaths [2]. Furthermore, CVD incidence and mortality in China are projected to increase substantially in the next 20 years [3]. Hypercholesterolemia and hyperglyceridemia are well-recognized risk factors for development of atherosclerosis and CVD [4–6]. Incidence of central obesity, glucose intolerance, hypertension, high blood levels of triglyceride, and low blood levels of high-density lipoprotein-cholesterol (HDL-C) represent the “pentad” of metabolic syndrome. In China, the blood lipid levels present an increasing trend now, even if blood lipid levels and prevalence of dyslipidemia are lower than those in most developed countries [7]. However, to our best knowledge, there is not any study on serum lipid profile in the Yi people in literatures.

The Chinese populations comprise 56 ethnic groups, of which the Han people accounts for approximately 93 percent of the total, and spreads throughout the country. The Yi people are one of the most primitive ethnics throughout the world and lives in the remote mountainous areas in southwestern China. The Yi farmers always live scattered on the top of mountains, isolated from the outside world, and keep primitive lifestyles with their own language. In recent decades, some of them have migrated to towns

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http://dx.doi.org/10.1016/j.atherosclerosis.2012.06.009

or cities and changed their lifestyles (similar to the Han people). Our past studies found that prevalence of type 2 diabetes mellitus (T2DM) in the Yi farmers and migrants was 4.33 percent and 9.03 percent, respectively, in 2008, which were lower than those of the national average level (9.70%) in the same time period [8]. And, the Yi farmers also presented the lowest prevalence of hypertension in China [9].

The Yi farmers and migrants have same genetic background but different environmental exposure and lifestyles. These two groups provide an unusual opportunity to compare effects of environmental and behavioral factors on serum lipid levels. We conducted a cross-sectional study in the Yi people, including farmers and migrants, to understand prevalence of dyslipidemia in these two groups and its associated factors.

2. Materials and methods

2.1. Participants

A cross-sectional study was carried out from August 2007 to August 2008 in Liangshan Yi Autonomous Prefecture (including Xichang city, Butuo, Zhaojue, Jinyang, Puge and Xide counties), Sichuan province, southwestern China. A sample of 2848 Yi people, including 1538 farmers and 1310 migrants, aged 18–87 years were recruited. There are one to four county seats in each county. The Yi farmers were selected by stratified cluster sampling from areas around each county seat. Four villages were randomly selected from each area. In the last sampling stage, all the Yi farmers aged 18 years or over in the selected villages were surveyed. The Yi migrants were defined as the Yi people who had migrated to one of the county seats, or Xichang city, for more than five years prior to the survey. Because the number of the Yi migrants was relatively small, all of the Yi migrants (18 years of age and over) found in the selected county seats and Xichang city were all enrolled into the study. The local CDC and government informed the selected participants one month before the survey carried out. All of the participants were interviewed at the designated location, such as government offices and township healthcare center. For Yi farmers, their birth and continuous residence places from their birth were mountain areas. Both of their parents were Yi people. For Yi migrants, their birth places were mountain areas and they continuously resided in county seats or Xichang city for at least 5 years after their emigration. Both of their parents were Yi people. The response rate of Yi farmers and migrants were 95% and 89%, respectively. The study was approved by the bioethic committee of the Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences (approval No. 015-2011).

2.2. Measurements

Age, race, gender, educational level, physical activity, cigarette smoking, and alcohol consumption were ascertained by local physicians fluent in both the Yi and Chinese languages. In the survey morning, overnight fasting venous blood specimens were collected from each participant, which then were shipped to the central clinical laboratory in Beijing and kept at 40 °C below zero before being analyzed. Plasma level of glucose was determined by glucose oxidase method. Serum level of high-density lipoprotein-cholesterol (HDL-C) was determined by chemical precipitation method, and serum levels of total cholesterol (TC) and triglyceride (TG) were determined by enzymatic methods. All biochemical analyses were done using a Hitachi 7600 automatic analyzer (Boehringer Mannheim, Mannheim, Germany). Low-density lipoprotein-cholesterol (LDL-C) was estimated by Friedwald formula: LDL-C = TC-(TG/2.2+HDL-C) mmol/L. Blood pressure was measured to the nearest 2 mm Hg on the right arm in a sitting position using a standard mercury sphygmomanometer. The second and third measurements were taken after a 2-min resting period, and the mean of three consecutive readings was used for analysis. Body weight was measured on a physician balance beam scale and body height was measured by a portable stadiometer to the nearest 0.1 kg and 0.1 cm, respectively, with the participants wearing light clothing and no shoes.

2.3. Definitions

Type 2 diabetes mellitus (T2DM) was diagnosed according to the WHO criteria 1999: fast plasma glucose (FPG) equal to or greater than 7.0 mmol/L, or the participant had his/her individual history of T2DM.

Hypertension was defined as systolic blood pressure equal to or more than 140 mm Hg and/or diastolic blood pressure equal to or more than 90 mm Hg, or the participant had his/her individual history of hypertension.

Overweight was defined as body mass index (BMI) equal to or greater than 25 kg/m^2 and less than 30 kg/m^2. Obesity was defined as BMI equal to or greater than 30 kg/m^2.

Dyslipidemia was defined according to ATP III. High TC was defined as serum level of TC equal to or greater than 6.21 mmol/L ($\geq$240 mg/dL). Low HDL-C was defined as serum level of HDL-C less than 1.03 mmol/L ($<$40 mg/dL). High LDL-C was defined as serum level of LDL-C equal to or greater than 4.16 mmol/L ($\geq$160 mg/dL). High TG was defined as serum level of triglyceride equal to or greater than 2.26 mmol/L ($\geq$200 mg/dL). The ratio of TC/HDL-C equal to or greater than five was defined as abnormal. All the participants were free of lipid-lowering medicines.

2.4. Statistical analysis

All data were analyzed with SAS version 9.2 software and SUDAAN version 10.0.1 software. Continuous data were expressed as mean $\pm$ SD and n(%) for discrete data. Prevalence of abnormal serum levels of TC, HDL-C, LDL-C, and TG were estimated by age- and gender-specific proportions. Prevalence was standardized according to age structure of the population census of China in 2000. Chi-square test and ANOVA were used to examine the differences between groups, and test for trend was used to analyze the significance of an increase or decrease in prevalence across stratifications. To evaluate the association between blood lipids and related factors, multivariate logistic regression analysis was used with abnormal serum levels of TC, TG, LDL-C, HDL-C and ratio of TC/HDL-C as dependent variables, respectively and demographic, anthropometric and lifestyle as the independent variables, with adjusted odds ratio (OR) presented together with a 95 percent confidence interval (95%CI). For statistical analysis, p-value less than 0.05 was considered statistically significant.

3. Results

Characteristics of the study participants are shown in Table 1, including age, BMI, serum levels of TC, TG, LDL-C and HDL-C, ratio of TC/HDL-C (presented as mean $\pm$ SD), family income, educational level, physical activity, gender, hypertension/T2DM and alcohol consumption/smoking status [presented as n(%)]. Significant difference in variables between the Yi farmers and migrants was observed ($p < 0.05$), except age and smoking status. The Yi migrants had significantly higher mean serum levels of lipids than the Yi farmers but HDL-C. About 70 percent of the Yi farmers had family income less than 1000 Chinese yuan per year, about 98 percent of them had educational level of high school or below, and nearly 90