



Serum Lipid Abnormalities and Nonalcoholic Fatty Liver Disease in Adult Males



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ABSTRACT

Background: Dyslipidemia is a risk factor for nonalcoholic fatty liver disease (NAFLD). The aim of our study was to determine the associations of serum lipid indexes with NAFLD in adult males.

Materials and Methods: In this cross-sectional study, 830 patients with NAFLD and 2,357 healthy individuals were assessed. Serum total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol and low-density lipoprotein cholesterol (LDL-C) levels were compared between patients with NAFLD and controls. The associations of dyslipidemia indexes with NAFLD occurrence were assessed by univariate analysis, and multivariate analysis was performed to identify independent dyslipidemia factors predictive of NAFLD.

Results: Of the 3,187 study subjects, NAFLD occurred in 830 (26.04%), there were 504 (60.72%) patients with mild disease and 326 (39.28%) patients with moderate-to-severe disease. Although the frequency of normal TC, TG, LDL-C and high-density lipoprotein cholesterol levels in patients with NAFLD was similar to the controls, the frequencies of patients with NAFLD with marginally high and high TC, TG and LDL-C levels were significantly different when compared with controls. Interestingly, the association of the number of abnormal serum lipid indexes and NAFLD was highly significant with 2 abnormalities (odds ratio = 1.977; 95% CI: 1.436-2.722; $P < 0.001$) and ≥ 3 abnormalities (odds ratio = 3.505; 95% CI: 2.466-4.982; $P < 0.001$).

Conclusions: A significant positive association was found between dyslipidemia characteristics and NAFLD in adult males.

Key Indexing Terms: Nonalcoholic fatty liver disease; Dyslipidemia; Dyslipidemia severity; Abnormal serum lipid profile. [Am J Med Sci 2017;353(3):236–241.]

INTRODUCTION

The incidence of nonalcoholic fatty liver disease (NAFLD), one of the most common causes of chronic liver disease, is increasing.¹ Recently, Salvoza et al² found that the prevalence of NAFLD ranges from 30-40% in the United States, 2-44% in Europe and 15-45% in Asia. NAFLD has been forecasted to become the most common cause for liver transplantation in the United States by 2020, as demonstrated by Charlton et al.³ Oresic et al⁴ obtained the result that NAFLD was shown to predict nonalcoholic steatohepatitis, type 2 diabetes and cardiovascular disease, independent of obesity. In addition, Gaggini et al⁵ found that NAFLD was suggested to be associated with insulin resistance, atherosclerosis, coronary heart disease and dyslipidemia.

Dyslipidemia plays an important role in the occurrence of NAFLD, as do other risk factors demonstrated in previous studies such as age, sex, ethnicity, hyperlipidemia, obesity, type 2 diabetes, environmental exposure and geographical region.⁶⁻¹¹ Dyslipidemia, a term used to describe an abnormal lipid metabolism, is characterized by high triglyceride (TG) and low high-density lipoprotein cholesterol (HDL-C) levels.^{12,13} Souza et al¹⁴ reported that dyslipidemia is associated with NAFLD in 20-80% of cases, among which the most

common form is characterized by hypertriglyceridemia, low HDL-C levels and high low-density lipoprotein cholesterol (LDL-C) levels. Hypertriglyceridemia is also reportedly present in 64% of patients with hepatic steatosis with low HDL-C levels reported in 30-42% of cases, as demonstrated by Marchesini et al.⁸

However, the correlation between dyslipidemia characteristics, including severity and the profile of abnormal serum lipids, and NAFLD occurrence remains unknown. We hypothesized that dyslipidemia characteristics are associated with the development and severity of NAFLD. Therefore, this study is conducted to assess the correlation between the degree of serum lipid profiles with NAFLD occurrence in adult males.

MATERIALS AND METHODS

Study Design

The study was approved by the ethics committee of the Medical Centre of Fangchenggang, the First People's Hospital. All participants provided written informed consent.

This cross-sectional study was part of the Fangchenggang Area Male Health and Examination Survey, assessing 4,303 men aged 18-88 years residing in Fangchenggang Area (Guangxi Autonomous Region),

who were recruited in the comprehensive demographic health survey. It was conducted at the Medical Centre of Fangchenggang at the First People's Hospital, between September and December 2009.

Study Population

Of the 4,303 participants, 3,187 were included in this study. The remaining 1,116 were excluded owing to the presence of at least 1 factor with potential risk for influencing fatty liver visualization on imaging. Exclusion criteria were as follows: (1) current diagnosis of diabetes mellitus, coronary heart disease, stroke, hyperthyroidism, rheumatoid arthritis or cancer ($n = 147$); (2) current diagnosis of hepatitis B virus indicated by positive test of hepatitis B surface antigen or a history of hepatitis ($n = 523$); (3) impaired hepatic function (alanine transaminase >2.0 times the upper limit of normal), liver cirrhosis or liver carcinoma ($n = 65$); (4) 12-month history of any medications known to cause fatty liver (images of bright echoes in the liver parenchyma) including steroids, methotrexate or other chemotherapeutic agents ($n = 45$); (5) excessive alcohol consumption (≥ 20 g/dL) ($n = 156$); (6) self-report of specific or nonspecific inflammation or antibiotic use within a month ($n = 125$); (7) diagnosis of nervous system disease or mental illness, or use of antipsychotics and antidepressants such as sedatives, and antiepileptic drugs and antidepressant drugs ($n = 61$); and (8) autoimmune diseases such as systemic lupus erythematosus ($n = 4$).

Definitions and Clinical and Laboratory Assessments

Trained personnel collected anthropometric measurements using a standardized protocol. A trained examiner collected body measurements, including weight and standing height. The body mass index (BMI) was calculated as weight (in kilograms) divided by squared height (in meters). Waist circumference was measured midway between the lowest ribs and the iliac at standing, and rounded to the nearest 0.1 cm. The participants were asked to reveal the number of days of alcohol consumption over the past 5 years, estimating the daily amounts. These data were used to calculate an average daily intake of alcohol based on a previously published method,¹⁵ in the case that consumption of 14 alcoholic drinks (1 drink not less than 10 g alcohol)

per month was reported. The data for smoking were collected, and the participants were divided into non-smoker or smoker groups.

Overnight fasting venous blood specimens were collected. Then, an automatic analyzer (Dade Behring, USA) was used to measure serum total cholesterol (TC), TG, HDL-C, LDL-C and alanine aminotransferase levels. Serum glucose levels were assessed enzymatically on a Dimension-RxL Chemistry Analyzer (Dade Behring, Newark, DE). Dyslipidemia was diagnosed according to the guidelines for prevention and treatment of dyslipidemia in Chinese adults,⁹ with particular criteria presented in Table 1.

Experienced investigators, blinded to the clinical and laboratory details of participants, performed abdominal ultrasound examinations using a portable ultrasound device (LOGIQe 5.0-MHz transducer; GE Healthcare, USA). Liver size, contour, echogenicity, structure and posterior beam attenuation were assessed for each participant. Diagnosis of NAFLD was made based on the presence of ultrasonography profiles consistent with liver brightness and echoes in the hepatic parenchyma compared with the renal parenchyma, vessel blurring and hepatic vein stenosis, as previously demonstrated^{9,16} and according to the guidelines for diagnosis and treatment of nonalcoholic and alcoholic fatty liver diseases published by the Fatty Liver and Alcoholic Liver Disease Study Group of the Chinese Liver Disease Association.^{10,11}

NAFLD was classified as mild or moderate-to-severe disease according to the echogenic hepatic fat accumulation intensities-based criteria described by Saadeh et al¹⁷ and Kim et al.¹⁸

Statistical Analysis

All statistical analyses were performed with the SPSS software (version 13.0; SPSS, USA). Continuous variables (age, BMI, waist circumference, glucose, alanine aminotransferase, TC, TG, LDL-C and HDL-C) were expressed as mean $\pm$ standard deviation. Categorical variables were expressed as a percentage. Continuous variables were compared by analysis of variance (ANOVA). Categorical data were compared using χ^2 test. Univariate and multivariate adjusted logistic regression models were applied to assess the association of NAFLD and dyslipidemia. The corresponding odds ratios (ORs), adjusted for age, BMI, cigarette smoking and

TABLE 1. Criteria used for dyslipidemia in various serum lipids, mmol/L.

	TC ^a	TG ^a	LDL-C ^a		HDL-C ^b
Reference range	<5.18	<1.70	<3.37	Abnormal range	<1.04
Marginally high	5.18-6.21	1.70-2.25	3.37-4.13	Normal	1.04-1.54
High	≥ 6.22	≥ 2.26	> 4.14	High	> 1.55
HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglyceride.					
^a The blood levels of TC, TG and LDL-C were classified into reference range, marginal high or high with earlier criteria.					
^b The blood level of HDL-C <1.04 mmol/L was abnormal. If >1.04 , the levels of HDL-C were classified into normal (1.04-1.54 mmol/L) and high (> 1.55 mmol/L).					

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