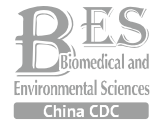


Original Article



Ideal Cardiovascular Health Metrics and Coronary Artery Calcification in Northern Chinese Population: A Cross-sectional Study*

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Abstract

Objective Coronary artery calcification (CAC) is a well-established risk predictor of coronary heart disease events and is recognized as an indicator of subclinical atherosclerosis.

Methods A cross-sectional study consisting of 2999 participants aged ≥ 40 years from the Jidong community of Tangshan City, an industrial and modern city of China, was conducted between 2013 and 2014 to examine the association between the ideal cardiovascular health (CVH) metrics and CAC. The ideal CVH metrics were determined based on the definition of the American Heart Association (AHA). The participants were then grouped into 4 categories according to the quartiles of their CVH metric scores as follows: first quartile (0-2), second quartile (3), third quartile (4), and fourth quartile (5-7). CAC was assessed by using high-pitch dual-source CT, and patients were identified based on thresholds of 0, 10, 100, or 400 Agatston units, as per common practice.

Results The prevalence of subclinical atherosclerosis was 15.92%, 13.85%, 6.76%, and 1.93%, determined by using the CAC scores at thresholds of 0, 10, 100, and 400 Agatston units, respectively. Compared with the group in the first quartile, the other three CVH groups had a lower odds ratio of CAC > 0 after adjusting for age, sex, income level, education level, and alcohol use in the logistic regression analysis. The odds ratios in these groups were 0.86 [95% confidence interval (CI), 0.63-1.17; $P < 0.05$], 0.75 (95% CI, 0.55-1.02; $P < 0.05$), and 0.49 (95% CI, 0.35-0.69; $P < 0.05$), respectively. These associations of CAC with the CVH metrics were consistent when different CAC cutoff scores were used (0, 10, 100, or 400).

Conclusion The participants with more-ideal cardiovascular metrics had a lower prevalence of subclinical atherosclerosis determined according to CAC score. Maintaining an ideal cardiovascular health may be valuable in the prevention of atherosclerosis in the general population.

Key words: Ideal cardiovascular health; Coronary artery calcification; Atherosclerosis

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INTRODUCTION

Coronary heart disease (CHD) is the single largest cause of death in developed countries and is one of the leading causes

of disease burden in developing countries, accounting for 7.3 million deaths and 58 million disability-adjusted life years (DALYs) worldwide in 2011^[1-2]. Inappropriate lifestyle factors increase the risk of CHD^[3-5], including smoking, poor quality diet,

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physical inactivity, excessive alcohol consumption, and obesity, which are major preventable causes of CHD and mortality^[3-5]. Epidemiological studies have showed the correlation between healthy lifestyle factors and reduced risks of myocardial infarction (MI) and CHD mortality^[6-9].

Coronary artery calcification (CAC), a marker of subclinical atherosclerosis, is well established as a risk predictor of CHD events^[10-12] and all-cause mortality^[13-14] in asymptomatic adults, and provides incremental prognostic information beyond that of traditional risk factors^[14-15]. Previous studies showed that normal body mass index (BMI)^[16], lipids^[17-19], blood pressure^[20], fasting blood glucose^[21], active physical activity^[22], and nonsmoking status were correlated with lower CAC scores^[23]. Noninvasive imaging detects CAC in minute amounts and thus is a valuable indicator of preclinical diseases in their early stages. However, limited evidence is available about the association between ideal cardiovascular health behavioral factors and subclinical atherosclerosis assessed based on CAC score, especially in China.

The American Heart Association (AHA) defined seven behaviors and risk factors (smoking status, BMI, physical activity, healthy dietary score, total cholesterol level, blood pressure, and fasting blood glucose level) as health metrics and created three stages for each metric to reflect poor, intermediate, and ideal cardiovascular health status^[24]. Identifying health behaviors and risk factors that are correlated with the maintenance of subjects' health is an important strategy for the prevention of CHD.

We hypothesized that ideal cardiovascular metrics would be a protective factor of subclinical cardiovascular disease (assessed based on CAC score)^[25]. Therefore, we conducted a cross-sectional study to investigate the association between ideal cardiovascular metrics and CAC in a Chinese population.

METHODS

Study Design and Participants

In the present investigation, we conducted a cross-sectional analysis of baseline data of the target population. This is a community-based, ongoing observational study aimed to investigate the progression of atherosclerosis in Chinese adults^[26]. Briefly, from July 2013 to August 2014, 9078 subjects aged ≥ 18 years who were residents in a community

in Jidong were recruited. Jidong is located in Tangshan City, which is a large and littoral modern city located in the southeast of Beijing. All data were handled and managed by using the Ruichi Precision Medical Record System (RPMRS), which was developed to standardize, integrate, manage, and analyze precision medical data.

The study included 2999 participants aged ≥ 40 years who had complete information on results of examinations for coronary artery calcification and peripheral arterial atherosclerosis. We excluded 204 participants with a history of stroke, myocardial infarction, heart failure, and cancer. A total of 2795 participants (1401 men and 1394 women) remained in the last analysis. During baseline survey, physical examinations and surveys were conducted by trained medical professionals from the Jidong Oilfield Corporation Medical Center. The study was conducted according to the guidelines of the Declaration of Helsinki. Ethical approval for the research protocol was obtained and written informed consents were approved by the ethics committee of Jidong Oilfield Corporation Medical Center prior to the study initiation. Written informed consents were obtained from all the participants.

Assessment of Cardiovascular Health Metrics

According to the guidelines by the American Heart Association, we defined the seven CVH metrics in three levels as follows: 'ideal,' 'intermediate,' and 'poor,'^[24]. Based on the score for healthy-diet behaviors, the dietary intake metric was classified as ideal (4 or 5 components), intermediate (2 or 3 components), or poor (0 or 1 component). The smoking metric was classified as ideal (never- or quit-smoking for >12 months), intermediate (former-smoking for ≤ 12 months), or poor (current smoking). Physical activity was classified as ideal (≥ 150 min/week of moderate intensity or ≥ 75 min/week of vigorous intensity), intermediate (1-149 min/week of moderate intensity or 1-74 min/week of vigorous intensity), or poor (none). BMI was classified as ideal (<25 kg/m²), intermediate (25-29.9 kg/m²), or poor (≥ 30 kg/m²). Blood pressure was classified as ideal [systolic blood pressure (SBP) of <120 mmHg, diastolic blood pressure (DBP) of <80 mmHg, and untreated], intermediate (SBP of 120-139 mmHg, DBP of 80-90 mmHg, and treated to goal), or poor (SBP of ≥ 140 mmHg or DBP of ≥ 90 mmHg). Fasting blood glucose level was classified as ideal (<100 mg/dL and untreated), intermediate (100-125 mg/dL and treated to goal),

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