

Original Article

The additive effect of adherence to multiple healthy lifestyles on subclinical atherosclerosis: Insights from the AWHS

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KEYWORDS:

Healthy lifestyle;
Atherosclerosis;
Coronary artery calcium;
Atherosclerotic plaque

BACKGROUND: Public health strategies targeting multiple healthy behaviors, rather than individual factors, have been proposed as more efficient strategies to promote cardiovascular health. However, the additive effect of multiple targets on primary prevention has not been fully characterized.

OBJECTIVE: To examine how adherence to multiple healthy behaviors is associated with the presence of subclinical atherosclerosis, a measure of early cardiovascular disease.

METHODS: Analysis of a baseline data from 1798 middle-aged men from the Aragon Workers Health Study conducted between 2009 and 2010. Healthy behaviors were defined according to American Heart Association recommendations, aligned with Spanish Nutritional recommendations and included moderate alcohol consumption, smoking abstinence, no abdominal adiposity, decreased sedentarism, and adherence to Alternate Mediterranean Dietary Index. Presence of coronary artery calcium and plaques in femoral and carotid was quantified by a 16-slice computed tomography scanner and 2D ultrasound.

RESULTS: Moderate alcohol consumption, as well as adherence to Mediterranean diet is independently associated with a 6% lower risk of having subclinical atherosclerosis. Smoking abstinence is associated with a 11% lower risk of subclinical atherosclerosis. Those who follow 3 lifestyle behaviors (Mediterranean diet, nonsmoking, and moderate alcohol intake) have 18% lower odds of

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presenting subclinical atherosclerosis compared with those who do not follow these protective lifestyle habits.

CONCLUSION: Adoption of multiple healthy lifestyle behaviors early in life could be a key strategy to tackle the onset of atherosclerosis and reduce cardiovascular disease burden.

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Introduction

Atherosclerosis is directly related to coronary heart disease (CHD) and affects a relatively young population.¹ American Heart Association considered CHD preventable through the lifestyle modifications such as limitation in alcohol consumption, smoking cessation, and physical activity, adherence to healthy diet, healthy weight maintenance, reduced stress, and control of blood cholesterol, blood pressure, and glucose levels.²

Studies have shown that unhealthy behaviors are prevalent, with most adults exhibiting more than 1 at a time in what is called a cluster of unhealthy lifestyles.³ The US National Health Survey of 16,818 adults revealed that a combination of at least 2 of the following lifestyle behaviors—excessive alcohol, cigarette smoking, overweight or physical inactivity—was prevalent among half of the US population.⁴ Thus, by addressing not only individual behavioral risk factors, but rather their combined effect, intervention strategies for cardiovascular health promotion could enhance their effectiveness.

Few studies have investigated the combined effect of adherence to multiple lifestyle factors on cardiovascular disease (CVD) mortality. Thus, Odegaard et al reported that those having at least 5 protective lifestyle factors (dietary pattern, physical activity, alcohol intake, usual sleep, smoking status, and body mass index) had one-fourth of the risk of CVD mortality compared to those with no protective lifestyle factors.⁵ In another study by Knuops et al, the authors estimated that lack of adherence to healthy lifestyle consisted of Mediterranean dietary pattern, moderate alcohol consumption, physical activity, and being nonsmoker accounted for a 64% of deaths from CHD and 61% from CVD.⁶ In terms of assessing how those lifestyle factors are associate with the early stage of the CHD most previous studies investigated the relationship between the combination of lifestyle behaviors and coronary artery calcification (CAC),^{7–9} or intima-media thickness (IMT)^{10,11} as markers of subclinical atherosclerosis.¹² CAC score (CACS) is considered a major predictor of CHD,¹³ a score of 0 being associated with only a 1% probability of having a cardiac event,¹⁴ whereas an elevated score, above 0, has been shown to be associated with a 10-fold increase in the risk of a cardiac event.¹³ Noteworthy, the limitation of CACS as a marker of atherosclerosis is that it can only be identified at late stages of disease progression, which makes it inadequate for its use in asymptomatic individuals. With respect to IMT, some studies have suggested a weak correlation with coronary atherosclerosis.¹⁵ To date, there are a limited number of studies exploring the

association between direct indicators of atherosclerosis, such as the presence of atherosclerotic plaques, and adherence to lifestyle behaviors. Moreover, most of them focus on atherosclerotic plaques located in carotid arteries. Assessment of femoral plaque compared with carotid might potentially become a useful tool in predicting CHD as it has been shown to be better correlated with traditional CVD risk factors.¹⁶ Therefore, in this study we aim to explore the relationship between adherence to multiple healthy lifestyle behaviors and presence of plaques in the femoral artery as well as other markers of subclinical atherosclerosis.

Methods

Study participants

The Aragon Workers Health Study (AWHS) is a longitudinal cohort study aiming to investigate the determinants of the development and progression of metabolic abnormalities and subclinical atherosclerosis among CVD-free middle-aged population. The participants were recruited between February 2009 and December 2010. The details of the study are described in detail elsewhere.¹⁷ The present study was performed on a sample of 1933 participants aged 40–55 y with complete baseline dietary, lifestyle and imaging data. Owing to the low percentage of females in AWHS and recognizing the differential effect of gender on health behaviors, we excluded female participants (N = 135, 0.5% of the sample). The final sample available for analysis was of 1798. The Central Institutional Review Board of Aragón approved the study, and written informed consent was obtained from all study participants.

Assessment of lifestyle behaviors

Information on lifestyle behaviors were collected using food frequency questionnaire and physical activity questionnaires previously validated for Spain.^{18,19} Dietary energy, macronutrient and micronutrient intakes were derived using the Spanish food composition tables.^{20,21} The variables used in the analyses were defined as follows: (1) alcohol: taking into account that there is no universal definition for moderate alcohol consumption, we have examined the evidence from several studies,^{22–24} dietary guidelines for Spanish population, which includes optional moderate alcohol intake in the form of wine or beer,²⁵ recommendations given by American Heart Association,²⁶ and considered the following categories for alcohol

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