

Original Article

Adherence to a Mediterranean diet is associated with the presence and extension of atherosclerotic plaques in middle-aged asymptomatic adults: The Aragon Workers' Health Study

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KEYWORDS:

Mediterranean diet;
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Femoral;
Carotid;
Aorta

BACKGROUND: The Mediterranean diet (MeDi) is known to prevent cardiovascular events but the mechanisms mediating this association are not fully understood.

OBJECTIVE: The objective of the study was to examine the association between MeDi adherence and the presence and extent of atherosclerotic plaques in carotid, femoral, and aorta territories and its relationship with risk factors in asymptomatic middle-aged adults.

METHODS: Cross-sectional analysis of the Aragon Workers' Health Study, a cohort of 2588 subjects (94.9% men aged 51.3 ± 3.89 years) without previous cardiovascular history. Participants underwent carotid, femoral, and aorta ultrasound for the quantification of number and thickness of plaques and intima-media thickness. To estimate the participant's adherence to MeDi, we computed the Alternative MEDiterranean index (aMED).

RESULTS: The overall aMED score was 4.19 ± 1.70 , representing a moderate adherence to MeDi. aMED score was associated with the presence of plaque in femoral arteries (odds ratio highest vs

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lowest aMED score quartile: 0.63; 95% confidence interval: 0.48–0.83; *P* trend = .045) independently of risk factors and mediators. The strongest association between aMED quartiles and presence of plaque was found among smokers, both in femoral (0.39 [0.22–0.69]; *P* trend = .001) and in any territory (0.33 [0.14–0.79], *P* trend = .008). aMED was inversely associated with the number of plaques in all territories except for carotids.

CONCLUSION: MeDi adherence showed a dose-dependent protective association with the presence, number, and thickness of plaques independent of other risk factors. The association was strongest for femoral arteries and among smokers.

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Introduction

Lifestyle plays an essential role in the prevention of non-communicable diseases and especially cardiovascular diseases (CVD), the main cause of morbidity and mortality in most countries.^{1,2} Among lifestyle behaviors, diet is directly related to major CVD risk factors such as dyslipidemia, hypertension, and diabetes.³ Mediterranean countries share dietary characteristics that are globally known as Mediterranean diet (MeDi), which has been related to health benefits such as CVD prevention.^{4–8} In agreement with this concept, Mediterranean countries show low CVD rates (mainly coronary disease) in spite of high prevalence of cardiovascular risk factors. This suggests a lower impact of these factors on CVD development in these countries.^{9,10} The PREvención con DIeta MEDiterránea (PREDIMED) trial showed that among individuals at high cardiovascular risk, a MeDi supplemented with extra-virgin olive oil or nuts reduced the incidence of major cardiovascular events.⁸ However, the mechanisms responsible for this benefit are not completely known. It is not fully understood if diet is solely responsible or if dietary patterns interrelate with other environmental factors by modulating the impact of cardiovascular risk factors on CVD.

The inverse association of MeDi with CVD could be mediated by the attenuation of atherosclerotic plaque development and progression.⁸ Some studies have investigated the effect of MeDi on carotid intima-media thickness (IMT) and have produced divergent results.^{11–14} The PREDIMED trial showed carotid atherosclerosis regression as IMT thinning in those participants after a MeDi supplemented with olive oil or nuts, and a baseline carotid IMT above 0.9 mm.¹¹ In the DIRECT-Carotid study, those subjects more compliant with the MeDi showed a decrease of 37.7 mm³ in the carotid vessel wall volume. However, it appeared to be mediated mainly by the weight loss-induced decline in blood pressure.¹³

Arterial IMT carotid wall volume is the result of multiple factors including age, blood pressure, and lipid and non-lipid depositions, and its measurement has been questioned as a predictor of CVD.^{15,16} In contrast, arterial plaques in medium size arteries are the hallmark of atherosclerosis

and their presence is predictive of CVD independent of traditional risk factors in several prospective studies.¹⁷ The presence of plaques has been mostly studied in carotid arteries by ultrasonography. Recently, in 2 large different studies, iliofemoral plaques identified by ultrasonography have demonstrated to be more frequent, better correlated with CVD risk factors, and highly associated with coronary calcium, even more than carotid plaques.^{18,19} The association of iliofemoral plaques to MeDi adherence has not been previously studied. So, we sought to examine the impact of MeDi adherence on presence and extent of atherosclerosis plaques in carotid, aorta, and iliofemoral territories and the impact of risk factors in these associations in the Aragon Workers' Health Study (AWHS) participants.

Material and methods

Study design

This study is a cross-sectional analysis of baseline imaging data from AWHS. The protocol for AWHS has been previously explained in depth.^{19,20} Briefly, the AWHS is a Spanish cohort, which aims to characterize the factors associated with metabolic abnormalities and subclinical atherosclerosis in a middle-aged population free of clinical CVD, who may be optimal target for primary prevention. The study involved 5400 employees of a car assembly plant in Figueruelas (Zaragoza, Spain) that were recruited during annual checkup in 2009 to 2012 and have undergone clinical examinations, laboratory assays, collection of biological materials for biobanking, and cardiovascular imaging screening (carotid, femoral, and abdominal ultrasonography and ankle–arm blood pressure score) every 3 years. Among 5400 employees who consented for participation into the study, subclinical atherosclerosis imaging was carried out to study participants who were aged 40 to 60 years at baseline.²⁰ As shown in Figure 1, 2571 subjects (2440 men and 131 women aged 40–60 years) were finally recruited into the AWHS imaging study from January 2011 to December 2014. Forty-seven subjects were excluded because they had previous history of CVD. The Aragon regional government's Ethics Committee for Clinical

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