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Adherence to a mediterranean diet and its association with age-related macular degeneration. The Coimbra Eye Study–Report 4

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ABSTRACT

Objectives: This study aimed to characterize the association of lifestyle and nutritional risk profiles with age-related macular degeneration (AMD) in two subpopulations with differing AMD prevalence.
Methods: This case-control study (n = 1992) included 768 patients with AMD and 1224 age- and sex-matched participants without AMD with a single visit at a primary health care unit. Enrolled participants completed a validated lifestyle and food frequency questionnaire. A score to measure adherence to the Mediterranean diet (mediSCORE; Range, 0–9) was constructed from individual food intakes, which were further analyzed by conversion to nutrient consumption.
Results: Higher adherence to the Mediterranean diet (mediSCORE ≥6) was significantly associated with no AMD (odds ratio [OR] = 0.73; $P = 0.009$). The subpopulation with lower AMD prevalence presented significantly higher adherence to the Mediterranean diet in relation to all individual food groups that comprised the mediSCORE ($P < 0.014$) with the exception of cereals. Food group analysis showed significant associations between the increased consumption of vegetables (OR = 0.63; $P < 0.001$) and fruit and nuts (OR = 0.78; $P = 0.010$) with no AMD. Nutrient analysis revealed that an increased ingestion of water, fibers, total fat, monounsaturated and polyunsaturated fatty acids, linoleic acid, vitamins A and C, carotene, alpha-tocopherol, folate, magnesium, iron, and zinc were significantly associated with no AMD ($P < 0.0013$). Finally, regular physical activity was associated with no AMD ($P = 0.003$).
Conclusions: High adherence to a Mediterranean diet and regular physical activity seem to be protective factors for AMD in a Portuguese population. The effect of the diet is likely driven by the increased consumption of vegetables, fruits, and nuts.

Introduction

Age-related macular degeneration (AMD) is a chronic disease of the central retina and the leading cause of irreversible blindness in the elderly population in developed countries [1–3]. There is a great need to identify preventive measures to delay or halt AMD progression, particularly in light of the current lack of effective pharmacologic options for the dry form of the disease,

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which presents in 0.61% of patients [4]. The only established intervention relates to the Age-Related Eye Disease Study (AREDS) [5], which showed that high-dose zinc/antioxidant supplements reduce progression from intermediate to late AMD. Preventive strategies through dietary modulation are attractive because they are easy to implement, relatively cheap, and could enable the development of specific dietary recommendations for people at risk of AMD.

Previous studies have suggested that certain micro- and macronutrients [5–10] such as lutein and zeaxanthin [11,12] and long-chain, omega-3 fatty acids [13,14] are beneficial. However, the association of single nutrients with AMD have often been inconsistent across studies and are impossible to disentangle from other aspects of diets as they do not account for the synergistic relationship of food components [15]. Therefore, an examination of the overall diet modeled on dietary guidelines/recommendations and AMD risk is important. Other modifiable risk factors for AMD have also been proposed including smoking [16–20], body mass index (BMI) outside the normal range [21], and physical activity [15,22]. Improved population health coupled with lifestyle guideline adherence will undoubtedly be beneficial to at-risk persons.

The aim of this study is to characterize the association between adherence to a Mediterranean diet and AMD in two subpopulations (one from a coastal town, the other from an inland town) with differing prevalence rates of AMD because, to the best of our knowledge, the protective role of the Mediterranean diet has already been investigated but studies are scarce [15,23–25].

Methods

Study design and population

This is a case-control study (NCT01715870) nested in the "Epidemiologic Study of the Prevalence of Age-Related Macular Degeneration in Portugal: The Coimbra Eye Study" (NCT01298674)–a cross-sectional, population-based study. In the Coimbra Eye Study, we included participants over 55 y of age from primary health care units in two locations in the center of Portugal: one in the coastal area (Mira–Coastal Town) and the other 70 km away from the sea (Lousã–Inland Town) [4,26].

For the present study, a select sample of participants with AMD (Rotterdam classification [27] 1–4) and an age- and sex-matched control group (Rotterdam classification 0–no AMD features or only drusen <63 μm) were invited to answer a validated lifestyle and food habits questionnaire. This study was approved by the Association for Innovation and Biomedical Research on Light and Image (AIBILI) Ethics Committee and all participants provided written informed consent.

We planned to enroll 1000 participants from each town over a 12-mo recruitment period. Participants who were previously graded with AMD were contacted first and the other participants (selected at random) were contacted to achieve an age- and sex-matched population. For the inland town, we contacted 1582 patients by phone and invited them to participate. Of these, 999 (63.1%) accepted and completed the questionnaire.

In the coastal town, because we had the "Five-year Incidence of Age-related Macular Degeneration in the Central Region of Portugal" study (NCT02748824) ongoing at the same time, a letter was sent to 1387 patients to invite them to also answer the questionnaire. Of the contacted participants, 1008 (72.7%) agreed to participate in this study. Therefore, a total of 2007 participants were included in this analysis (Fig. 1).

Age-related macular degeneration grading and staging

In the Coimbra Eye Study, all participants were subjected to a complete bilateral ophthalmologic examination with an evaluation of the best-corrected visual acuity, anterior segment biomicroscopy, tonometry, and digital mydriatic color fundus photograph (Topcon TRC-50 EX; Topcon Corp., Tokyo, Japan). Images were graded for the presence of AMD or no AMD in a centralized reading center (Coimbra Ophthalmology Reading Center, CORC–AIBILI) and a differential analysis for AMD lesions was conducted thereafter by two senior, independent, and certified ophthalmologists using the International Classification and Grading System for AMD [28]. Fifty participants who were graded with AMD were excluded from the study due to the low quality of the images (i.e., the presence of AMD lesions could not be confirmed due to other ocular pathologies such as cataract). The full study protocol of the "Epidemiologic Study of the Prevalence of Age-Related Macular Degeneration in Portugal: The Coimbra Eye Study" [4,26] has previously been described. In the coastal town, the grading results for the presence of AMD that were obtained in the incidence study were used (NCT02748824).

Demographic and lifestyle data

Demographic data as well as information on the participants' general and ophthalmic medical history were collected for all study participants in the original Coimbra Eye Study (NCT01298674 and NCT0274/8824). For this study, participants were invited to answer questionnaires that included information on education, smoking habits, and regular physical activity (i.e., any kind of exercise that was reported by the participant such as walking, cycling, fitness, swimming at least once a week), medical history, and food frequency. The food frequency questionnaire was adapted from the food frequency questionnaire by

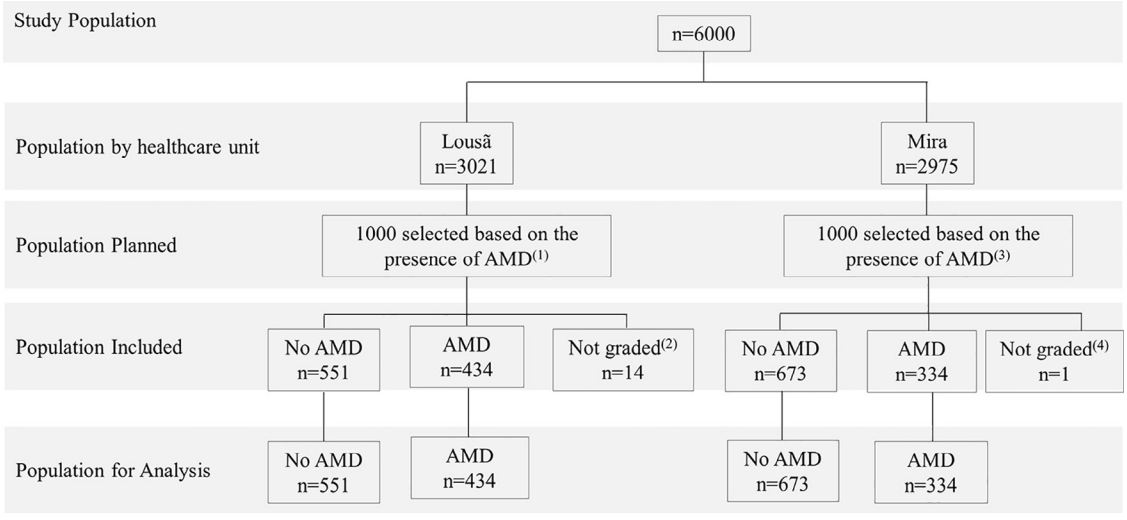

Fig. 1. Study flowchart. (1) Patients included from October 2012 to January 2014 in Lousã did not have their images graded for the presence of AMD when the questionnaire was administrated. (2) Images that were not graded due to lack of photo quality or obscuring lesions. (3) AMD presence was considered on the basis of the grading that was performed in the epidemiologic study. (4) Excluded because AMD grading could not be confirmed in the incidence study (2016–2017). AMD, age-related macular degeneration.