



Lifestyle determinants of healthy ageing in a Mediterranean population: The multinational MEDIS study

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ABSTRACT

Background: To evaluate modifiable, lifestyle risk factors of cardiovascular disease (CVD) among older adults, across ageing, in the Mediterranean area.

Methods: During 2005–2017, 3131 individuals from 26 Mediterranean islands of 5 countries, ≥ 65 years of age, were voluntarily enrolled. Anthropometrical, clinical and socio-demographic characteristics, dietary habits, lifestyle parameters were measured through standard procedures. Analyses were performed by year and across consecutive age groups of the participants.

Results: A decrease in the prevalence of current smoking ($p < 0.001$), engagement in physical activities ($p = 0.001$) and participation in social events ($p = 0.001$) for every year increase in age was found. Moderate alcohol drinking increased through ageing ($p = 0.008$), whereas adherence to Mediterranean diet remained stable, but adequate ($p = 0.90$). Trend analysis also revealed that a quadratic (U-shape) function better characterized the association between ageing and total cardiometabolic risk factors burden (p for trend < 0.001).

Conclusions: The gaps in the understanding of factors affecting longevity and healthy ageing remain; public health authorities and stakeholders should focus on the lifestyle determinants of healthy ageing, that seems to be an effective mean for improving older peoples' health.

1. Introduction

The population growth around the world is increasing rapidly. In 2015, people over 65 years of age represented 8.5% of the world's population, whereas by 2050 this percentage is expected to have doubled (He et al., 2016). This demographic change is attributed to the increase in life expectancy, due to medical care attainments the past decades, effectiveness of public health strategies, as well as improvements in food quality, food safety and living conditions (Van De Kaa, 1987).

Europe is currently facing one of the biggest challenges, which is to adapt European Union (EU) policies and strategies to meet the demands associated with this demographic change and assure healthy ageing (Courtin et al., 2014). In order, however to achieve healthy ageing it is necessary to identify and understand determinants of health and disease, as well as disease risk factors over time (Courtin et al., 2014).

People have different ageing pathways, as per their genetic profile, as well as due to different life course health risk exposures (Tosato et al., 2007). Ageing is associated with various lifestyle factors and

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early age exposures, and by the constantly changing nature and timing of these (Tosato et al., 2007). Furthermore, people's accessibility to health care services (Tyrovolas et al., 2011), nutrition quality, smoking status (regular or passive smoking), level of physical activity, anxiety & social life status, may also affect ageing over time (Passarino et al., 2016; Shadyab and LaCroix, 2015). Ageing, and more specifically healthy ageing, is largely determined by individual lifestyle choices and not so by genetic inheritance (Passarino et al., 2016). The interactive effects, therefore of exposures and health states or diseases over time requires assessment.

Mediterranean people have always had the “privilege” of living in a health-friendly environment, as climate and general conditions have tended people to adopt healthy living standards and avoid stressful factors (Bach-Faig et al., 2011, p.; Chrysoshoou et al., 2016). Therefore, and under the context of the MEDIS study (Tyrovolas et al., 2014), the aim of the present work was primarily to evaluate modifiable cardiovascular disease (CVD) lifestyle risk factors among older adults, across ageing, in the Mediterranean area; secondarily to evaluate the prevalence of cardiometabolic disorders and lifestyle characteristics across the course of ageing.

2. Material and methods

The Mediterranean Islands (MEDIS) study is an ongoing, large-scale, multinational observational project held in the Mediterranean region, which aims to explore the association of lifestyle habits, psycho-social characteristics and living environment, on cardiometabolic factors, among older people (> 65 years), permanent residents of the Mediterranean area (Tyrovolas et al., 2014).

2.1. The MEDIS study's sampling procedures

During 2005–2017, a population-based, multi-stage sampling scheme (i.e., stratified by island, and sex distribution of the referent population according to census 2001) was applied to voluntarily enroll 3131 men and women, over 65 years old, from 26 Mediterranean islands of 5 countries (i.e., Malta Republic (n = 250), Sardinia (n = 60) and Sicily (n = 50) in Italy, Republic of Cyprus (n = 300), Mallorca and Minorca (n = 111) in Spain, Gökçeada (n = 55) in Turkey and the Greek islands of Lesbos (n = 142), Samothraki (n = 100), Cephalonia (n = 115), Crete (n = 131), Corfu (n = 149), Limnos (n = 150), Ikaria (n = 76), Syros (n = 151), Naxos (n = 145), Zakynthos (n = 103), Salamina (n = 147), Kassos (n = 52), Rhodes and Karpathos (n = 149), Tinos (n = 129), Ai Stratis (n = 30), Spetses (n = 92), Aegina (n = 59), Paros (n = 90) as well as the rural region of east Mani (n = 295). Inclusion criteria consisted of free-living participants, permanently residing on the islands and being over 65 years old. An attempt to include participants from various villages of each island was made in order to increase representativeness. Participants were enrolled on a feasibility basis. Exclusion criteria consisted of individuals who resided in assisted-living centers, had a clinical history of cardiovascular disease (CVD) or cancer, or had left the island for a considerable period of time during their life (i.e., > 5 years), since the study aimed to assess lifestyle patterns that were not subject to modifications due to existing chronic health conditions or by environmental factors other than the immediate living milieu.

A group of experienced health scientists (physicians, dietitians, public health nutritionists and nurses) collected the required information through personal interviews and using standard procedures and validated questionnaires.

2.2. Bioethics

The study followed the ethical recommendations of the World Medical Association (52nd WMA General Assembly, Edinburgh, Scotland, October 2000). The Institutional Ethics Board of Harokopio

University approved the study design (16/19-12-2006). Participants were informed about the aims and procedures of the study and gave their written consent prior to the interview.

2.3. Evaluation of socio-demographic and lifestyle characteristics and health care services

Basic socio-demographic characteristics such as age, sex, as well as lifestyle, such as smoking habits, physical activity status, number of friends and living status were also recorded. Current smokers were defined as those who smoked cigarettes or any type of tobacco at the time of the interview. Former smokers were defined as those who previously smoked, but had not done so for a year or more. Current and former smokers were further classified as ever smokers. The remaining participants were classified as non-smokers. Physical activity was evaluated in MET-minutes per week, using the short, translated and validated into Greek, version of the self-reported International Physical Activity Questionnaire (IPAQ) (Papathanasiou et al., 2009). Individuals who had at least 3 MET-minutes were defined “adequate physically active”. The “number of friends” declared by respondents was based on their perception of how many friends they reported at the time of the interview, whereas “living status” was based on whether they live alone or not at the time of the interview. Participants who engaged in social events (e.g., going out with friends or relatives, participating in social activities) at least once a week over the last 12 months were characterized as “socialized”. The presence of small physicians' offices, health care centers, or hospitals in the area of living, and the annual number of visits for regular health status check-ups, during winter and summer, by the participants were recorded. In addition, individuals were asked to declare if economic reasons that affect the visits to health care services were existed.

2.4. Dietary assessment

A validated food frequency questionnaire (FFQ) was used in the study's participants to capture their dietary habits (Tyrovolas et al., 2010). To evaluate the level of adherence to the Mediterranean diet, the MedDietScore (range 0–55) was used (Panagiotakos et al., 2006). Higher MedDietScore indicate greater adherence to the Mediterranean diet and better quality in terms of health (a threshold of 35 – the median value – was used to categorize participants as closer to the traditional dietary pattern). Furthermore, consumption of various alcoholic drinks was measured in terms of wineglasses per day, adjusted for ethanol intake (e.g. one 100 mL glass of wine was considered to have 12% ethanol) and classified into never/rare (i.e., no alcohol drinking) or 1 to 2 glasses per day (moderate consumption) and to > 2 glasses per day.

2.5. Evaluation of clinical characteristics

All measurements performed in the study's centres were standardized; a common questionnaire, translated to the language of each country, following the World Health Organization (WHO) translation guidelines for tools assessment, was administrated (WHO, n.d.). Weight and height were measured using standard procedures to attain body mass index (BMI) scores (kg/m²). Obesity was defined as BMI > 29.9 kg/m². Type 2 Diabetes mellitus was determined by measuring fasting plasma glucose and values were used in accordance with the American Diabetes Association diagnostic criteria (fasting blood glucose levels ≥ 126 mg/dL or use of special antidiabetic medication) (Alberti and Zimmet, 1998). Blood pressure was measured by trained physicians or nurses with participants in a sitting position and calm. An average of the 3 measurements was calculated. Participants who had blood pressure levels > 140/90 mm Hg or used antihypertensive medications were classified as hypertensive (Mancia et al., 2013). Fasting blood lipids levels were also recorded and hypercholesterolemia was defined as

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