Factors Associated With Components of Arterial Pressure Among Older Individuals (the Multinational MEDIS Study): The Role of the Mediterranean Diet and Alcohol Consumption

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The aim of this work was to evaluate factors associated with arterial blood pressure in a sample of older Mediterranean people without known cardiovascular disease. During 2005 to 2011, 2813 older (aged 65–100 years) individuals from 22 Mediterranean islands and the rural Mani region (Peloponnesus) voluntarily enrolled. Standard procedures were used to determine arterial BP and pulse pressure and for the evaluation of dietary habits (including tea and alcoholic beverages consumption), lifestyle, and anthropometric and clinical characteristics of the participants. Participants who reported low alcohol consumption (ie, 0–1 glasses per day) were less likely to have hypertension (odds ratio, 0.34; 95% confidence interval, 0.14–0.84) as compared with those who reported high alcohol consumption (ie, 5+ glasses per day). Adherence to the Mediterranean diet was inversely associated with mean arterial pressure (β coefficient, −0.18; 95% confidence interval, −0.33 to −0.16). Alcohol drinking remains an important modifiable risk factor for hypertension. Adherence to the Mediterranean diet was associated with decreased arterial peripheral resistance. *J Clin Hypertens (Greenwich).* 2014;16:645–651. © 2014 Wiley Periodicals, Inc.

According to the World Health Organization, arterial hypertension constitutes an important modifiable risk factor related to 4.5% of the worldwide disease burden and is associated with an approximately 40% reduction of stroke risk and 15% reduction of myocardial infarction risk when treated and controlled.[1] As a result of improved longevity rates in developed countries, hypertension constitutes a major public health problem, especially in older adults, affecting half of those aged 60 to 69 years and around three quarters of those aged older than 70 years.[2]

Recently, it has been reported that the use of components of blood pressure (BP) measurement (ie, mean arterial pressure [MAP] and pulse pressure [PP]) different from the traditional single ones (systolic BP [SBP] and diastolic BP [DBP]) provides a broader image in the prediction of cardiovascular disease (CVD) risk.[3] MAP is a measure of cardiac output and peripheral resistance,[3,4] whereas PP reflects the stiffness of the large arteries, which increases with advancing age (older than 50 years), because of opposing trends in SBP and DBP.[5–7] It has been reported that the aging process plays a major role in shifting the relationship between BP components and CVD risk.[8]

In parallel, anthropometric parameters and dietary patterns constitute, among genetic, sociodemographic, and other factors, important determinants of arterial BP. Among dietary patterns, the Mediterranean diet has been regarded as a healthy one, exhibiting favorable associations with various CVD risk factors.[9,10] As a component of the Mediterranean diet, alcohol restriction has been shown to be an effective lifestyle intervention for both systolic and diastolic BP reduction.[11] Specifically, the dose-response relationship of alcohol and BP has been found to be either linear or J-shaped,[12,13] while the dose-response relationship of alcohol and coronary heart disease is J-shaped only.[14]

Regarding BP, Mediterranean diet has been shown to have a neutral association with the incidence of hypertension and an inverse relationship with both systolic and diastolic arterial pressure in follow-up studies.[15] In addition, cross-sectional studies in Greece have reproduced an inverse association between adherence to the Mediterranean diet and hypertensive status in Mediterranean populations.[9,16] To date, a series of studies have investigated the role of Mediterranean diet in BP, taking into account the traditional measurements (SBP, DBP, and hypertension). However, to the best of our knowledge, no study has investigated the role of the

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Mediterranean diet and other dietary components in BP hydraulic loads (PP and MAP) in older Mediterranean adults.

Given the alarming increase in hypertension rates of older adults, the complexity of arterial BP and the lack of MAP and PP data among Mediterranean populations, the aim of the present work was to evaluate the role of various factors in different components of arterial BP in a random sample of older adults living in the Mediterranean basin and participating in the multinational Mediterranean Islands (MEDIS) study.[10]

METHODS

The MEDIS Study Sample

During the period 2005–2011, a population-based, multi-stage convenience sampling method was used to voluntarily enroll elders from 22 Mediterranean islands: Republic of Cyprus (n=300), Malta (n=250), Sardinia (n=60) and Sicily (n=50), Balearic Islands (Mallorca and Menorca, n=111), the Greek islands of Mitilini (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), and Evoia (n=150), as well as from the rural region of Mani (n=153) (a southern Greek peninsula). According to the study protocol, individuals were not eligible for inclusion if they resided in assisted-living centers, had a clinical history of CVD or cancer, or had lived away from the island for a considerable period of time during their lives (ie, >5 years); these exclusion criteria were applied because the study aimed to assess lifestyle habits that were not subject to modifications due to existing chronic health conditions or by environmental factors, other than living milieu. A group of health scientists (ie, physicians, dietitians, and nurses) with experience in field investigation collected all the required information using a quantitative questionnaire and standard procedures.

Bioethics

The study followed the ethical considerations provided by 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 consent prior to being interviewed.

Evaluation of Clinical Characteristics

All the measurements taken in the different study centers were standardized. Weight and height were measured using standard procedures to attain body mass index (BMI) scores (kg/m^2). A standard procedure was also used for the measurement of waist circumference. Overweight was defined as BMI between 25 kg/m^2 and 29.9 kg/m^2, while obesity was defined as BMI >29.9 kg/m^2. Diabetes mellitus (type 2) was determined by fasting plasma glucose tests and was analyzed in accordance with the American Diabetes Association diagnostic criteria (glycated hemoglobin A_{1c} ≥6.5 or fasting blood glucose levels >125 mg/dL or 2-hour plasma glucose >200 mg/dL during an oral glucose tolerance test, a random plasma glucose >200 mg/dL, or prior diagnosis of diabetes).

BP 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 systolic/diastolic BP levels ≥140/90 mm Hg or used antihypertensive medications were classified as hypertensive. Moreover, MAP and PP were calculated. Specifically, MAP was calculated using the equation: MAP=[(2*diastolic pressure)+systolic pressure]/3. PP was calculated with the formula: PP = systolic pressure – diastolic pressure.[4,17] Fasting blood lipid levels (high-density lipoprotein and low-density lipoprotein cholesterol and triglycerides) were also recorded and hypercholesterolemia was defined as total serum cholesterol levels >200 mg/dL or the use of lipid-lowering agents according to the Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) guidelines.[18]

Evaluation of Dietary Habits and Sociodemographic and Other Lifestyle Characteristics

Dietary habits were assessed through a semi-quantitative, validated, and reproducible food-frequency questionnaire.[19] Frequency of consumption of various food groups and beverages (ie, meat and products, fish and seafood, milk and other dairy, fruits, vegetables, greens and salads, legumes, cereals, coffee and tea, and soft drinks) on a daily, weekly, or monthly basis was assessed. Since noncaffeinated coffee and tea was poorly consumed by the participants (<1%), they were not included in the analyses. Furthermore, consumption of various alcoholic beverages (ie, wine, beer, whiskey, vodka, and the traditional ouzo, tsipouro, and retsina) was measured in terms of wineglasses per day, adjusted for ethanol intake (eg, one 100 mL glass of wine was considered to have 12% ethanol) and classified into never/rare (ie, no alcohol drinking), 0 to 1 glasses per day, 2 glasses per day, 3 to 4 glasses per day, and 5 or more glasses per day. To evaluate the level of adherence to the Mediterranean diet, the MedDietScore (theoretical range 0–55) was used.[20] Higher values for this diet score indicate greater adherence to the Mediterranean diet.

Basic sociodemographic characteristics such as age; sex; years of education; urban residence; financial status; and lifestyle characteristics, such as living alone, smoking habits, and physical activity status, were also recorded. Regarding financial status, participants were asked to report their financial status, considering their mean income during the previous 3 years according to a 4-point scale (low, inadequate to cover daily expenses=1; medium, trying hard to cover daily expenses=2; good, adequate to cover daily expenses=3; high, very adequate to cover daily expenses=4). This

scale was decided upon because of the variety of the populations studied, as well as the common difficulty of accessing exact financial data. The participants who were in the upper category were classified as having high financial status, while all the others were classified as having low and medium financial status (high vs low-medium financial status). Current smokers were defined as smokers at the time of the interview. Ever smokers were defined as those who reported smoking during their lifetime. Physical activity was evaluated in metabolic equivalent of task (MET) minutes per week using the shortened, translated, and validated Greek version of the self-reported International Physical Activity Questionnaire (IPAQ).[21] Minimally active—or "health-enhancing physical activity (HEPA) active"—were classified as those who reported at least 3 MET minutes per week and considered for the purposes of this work as physically active.

Further details about the MEDIS study protocol may be found elsewhere.[10,22]

Data Analysis

Prevalence of hypertension was calculated as the rate of cases divided by the study sample. Normally distributed continuous variables were presented as mean±standard deviation and categorical variables as frequencies. Comparisons of continuous variables between groups were performed using the independent samples *t* test (for normal distribution) and the Mann-Whitney *U* test (for skewed distribution). Multiple logistic regression analysis was estimated in order to evaluate the association between the presence of hypertension (dependent outcome) and participant characteristics (ie, age, sex, urban residence, living education and financial status, current smoking habits, bioclinical factors) (independent variables). Hosmer-Lemeshow criterion was used to evaluate the model's goodness of fit. Moreover, multiple linear regression analysis was performed in order to evaluate the association between the level of MAP and PP (dependent outcomes) and participant characteristics (ie, age, sex, urban residence, living alone education and financial status, smoking habits, bioclinical factors) (independent variables). Colinearity was tested using the variance inflation factor criterion (values >4 suggested colinearity between independent variables, with one being excluded from the model). The assumption of homoscedasticity was tested by plotting the scatter plot of standardized residuals over the predicted score values. Results from linear regression models are presented as β coefficients and their 95% confidence intervals (CIs). All reported *P* values were based on two-sided tests. SPSS software, version 20 (IBM Inc, Armonk, NY) was used for all calculations.

RESULTS

Of the studied sample of 2732 participants, 1674 (61%) had hypertension (57% men and 66% women, *P*<.001). However, when the 7 geographical areas of the participants were taken into account (West Mediterranean, Ionian, Aegean, Saronikos islands, Crete island, Mani, and Cyprus Republic), the inhabitants of Crete had the highest prevalence of hypertension (ie, 84%), while the participants living in the West Mediterranean islands (Malta, Sardinia, Sicily, Balearic islands) had the lowest (ie, 46%) (*P*<.001). Factors associated with the prevalence of hypertension among older Mediterranean natives are presented in Table I. Compared with normotensives, the hypertensive participants were less physically active (*P*=.06), less educated, had fewer smokers (*P*<.001), had lower financial status (*P*=.02), reported lower alcohol drinking (*P*=.05) and higher tea

TABLE I. Sociodemographic, Clinical, and Lifestyle Characteristics in Relation to Hypertension Status of the Multinational Mediterranean Islands (MEDIS) Study Participants

	Normal	Hypertensive	*P* Value
No.	1058	1674	
Male sex, %	55	46	<.001
Age, y	73.3±7.6	74.5±7.1	<.001
Older adults (>80 years), %	39%	28%	.12
Living in urban areas, %	58%	62%	.08
Education status (in school years)	7.0±4.1	6.6±3.8	<.001
High financial status,[a] %	22	17	.02
Living alone, %	22	27	.007
Diabetes, %	14	27	<.001
Hypercholesterolemia, %	35	57	<.001
Obesity, %	25	38	<.001
Body mass index, kg/m^2	27.7±10.0	29.0±4.8	<.001
Systolic blood pressure, mm Hg	127±14	140±17	<.001
Diastolic blood pressure, mm Hg	76±9	79±11	<.001
Mean arterial pressure, mm Hg	93±10	99±11	<.001
Pulse pressure, mm Hg	51±13	60±16	<.001
Current smoking, %	19	13	<.001
Physically active,[b] %	61	42	.06
MedDietScore (0–55)	32.6±5.3	32.7±5.0	.68
Alcohol drinking, % daily drinking, >1 glass	50	46	.05
Coffee drinking, % daily drinking, >1 cup	82	82	.92
Tea drinking, % daily drinking, >1 cup	36	41	.007

P values were derived using *t* test for the continuous variables or chi-square test for the categorical variables.

[a]Financial status was defined using the mean income during the previous 3 years. "High" was considered very adequate to cover daily expenses according to participants' reports. [b]Were defined as those who had engagement in physical activities with at least 3 metabolic equivalent of task minutes per week expenditure.

drinking (*P*=.007), were more likely to live alone (*P*=.007), and had a higher prevalence of obesity, diabetes, and hypercholesterolemia and higher levels of BMI (*P*<.001), MAP, and PP (*P*<.001).

After adjusting for age; sex; urban residence; physical activity; living alone; education and financial status; smoking habits; adherence to the Mediterranean diet; and alcohol, tea, and coffee consumption, it was revealed that diabetic, obese, and hypercholesterolemic older adults were more likely to have hypertension (Table II). Greater adherence to the Mediterranean diet was beneficially associated with the presence of hypertension (*P*<.08). Moreover, it was found that low alcohol consumption (ie, 0–1 glasses per day [odds ratio (OR), 0.34; 95% CI, 0.14–0.84]) was associated with less likelihood of being hypertensive, compared with high alcohol consumption (ie, 5+ glasses per day).

In order to assess a wider spectrum of arterial BP indices, the relationship of MAP and PP with a variety of factors was evaluated (Table III). After adjusting for various confounders, education status (β coefficient, −0.38; 95% CI, −0.69 to −0.07) and physical activity (β coefficient, −2.26; 95% CI, −4.25 to −0.28) were inversely associated with PP, while obesity (β coefficient, 3.18; 95% CI, +1.21 to +5.15), diabetes (β coefficient, 3.21; 95% CI, +1.01 to +5.41), living alone (β coefficient, 2.19; 95% CI, +0.05 to +4.33), and high financial status (β coefficient, 3.00; 95% CI, +0.41 to +5.60) were positively associated with PP. Moreover, adherence to the Mediterranean diet (β coefficient, −0.18; 95% CI, −0.33 to −0.16) was inversely associated with level of MAP, while a positive association was associated with obesity (β coefficient, 1.51; 95% CI, +0.20 to +2.82) and high financial status (β coefficient, 1.86; 95% CI, +0.07 to +3.64).

TABLE II. Factors Associated With the Presence of Hypertension Among Older Individuals Living in the Mediterranean Basin (the Multinational Mediterranean Islands [MEDIS] Study)

	Odds Ratio	95% CI
Age (per 1 year)	1.06[a]	1.03–1.09
Male vs female sex	0.73	0.46–1.15
Urban vs rural area of residence	1.39	0.97–1.99
Education (per 1 year)	1.02	0.97–1.07
Living alone (yes vs no)	1.49	0.95–2.32
High financial status (yes vs no)	1.36	0.87–2.13
Diabetes (yes vs no)	2.02[a]	1.25–3.26
Hypercholesterolemia (yes vs no)	1.85[a]	1. 30–2.62
Obesity (yes vs no)	2.16[a]	1.44–3.25
Smoking current (yes vs no)	0.74	0.49–1.12
Physical activity (yes vs no)	1.18	0.82–1.72
MedDietScore (per 1/55 unit)	0.96	0.92–1.00
Daily coffee drinking (yes vs no)	1.42	0.85–2.37
Daily tea drinking (yes vs no)	1.11	0.77–1.59
Alcohol drinking		
5+ glasses of wine per day	Reference category	
0–1 glasses of wine per day	0.34[a]	0.14–0.84
2 glasses of wine per day	0.41	0.16–1.03
3–4 glasses of wine per day	0.51	0.19–1.22

[a]*P* values <.05. Results are presented as odds ratios and their corresponding 95% confidence intervals (CIs). Reference categories are expressed as "no" unless otherwise stated (eg, alcohol drinking).

TABLE III. Results From Regression Models that Evaluated Factors Associated With Pulse Pressure and Mean Arterial Pressure Among Older Individuals Living in the Mediterranean Basin (the Multinational Mediterranean Islands [MEDIS] Study)

	B Coefficient	95% CI
Model for pulse pressure		
Age (per 1 year)	0.003	−0.14 to +0.14
Male vs female sex	−0.53	−2.76 to +1.70
Living in urban area (vs rural)	0.06	−1.90 to +2.02
Education status (per 1 year)	−0.38[a]	−0.69 to −0.07
Living alone (yes vs no)	2.19[a]	+0.05 to +4.33
High financial status (yes vs no)	3.00[a]	+0.41 to +5.60
Diabetes (yes vs no)	3.21[a]	+1.01 to +5.41
Hypercholesterolemia (yes vs no)	−1.37	−3.30 to +0.55
Obesity (yes vs no)	3.18[a]	+1.21 to +5.15
Smoking current (yes vs no)	−1.04	−3.87 to +1.79
Physical activity (yes vs no)	−2.26[a]	−4.25 to −0.28
MedDietScore (per 1/55 unit)	−0.09	−0.33 to +0.15
Daily coffee drinking (yes vs no)	0.85	−1.68 to +3.39
Daily tea drinking (yes vs no)	1.05	−0.82 to +2.94
Daily alcohol drinking (yes vs no)	1.34	−0.73 to +3.41
Model for mean arterial pressure		
Age (per 1 year)	0.04	−0.05 to +0.13
Male vs female sex	−0.36	−1.85 to +1.13
Living in urban area (vs rural)	−0.18	−1.49 to +1.25
Education status (per 1 year)	−0.10	−0.31 to +0.10
Living alone (yes vs no)	1.14	−0.28 to +2.57
High financial status (yes vs no)	1.86[a]	+0.07 to +3.64
Diabetes (yes vs no)	0.85	−0.61 to +2.32
Hypercholesterolemia (yes vs no)	0.47	−0.81 to +1.75
Obesity (yes vs no)	1.51[a]	+0.20 to +2.82
Smoking current (yes vs no)	0.31	−1.58 to +2.20
Physical activity (yes vs no)	0.89	−0.43 to +2.21
MedDietScore (per 1/55 unit)	−0.18[a]	−0.33 to −0.16
Daily coffee drinking (yes vs no)	−0.17	−1.86 to +1.52
Daily tea drinking (yes vs no)	0.88	−0.37 to +2.14
Daily alcohol drinking (yes vs no)	−1.17	−2.55 to +0.21

[a]*P* values <.05. Results are presented as β coefficients and their corresponding 95% confidence intervals (CIs). Reference categories are expressed as "no" unless otherwise stated (eg, alcohol drinking).

DISCUSSION

The present study revealed high levels of morbidity (ie, obesity, hypercholesterolemia, diabetes) and MAP and PP among older Mediterranean hypertensive islanders. According to recent evidence on the use of MAP (indicator of arterial resistance) and PP (indicator of arterial stiffness), these two major cardiac hydraulic load components offer a wider image of CVD risk.[3] Following this approach, multi-adjusted analysis

revealed that greater adherence to the Mediterranean diet was associated with lower MAP levels and tended to be inversely associated with the presence of hypertension. Furthermore, low and medium alcohol consumption is a part of the traditional holistic Mediterranean diet.[20] Data analysis revealed that alcohol restriction compared with high alcohol consumption was inversely associated with the presence of hypertension, irrespective of age, sex, urban residence, smoking habits, education and financial level, physical activity, obesity, diabetes, hypercholesterolemia, adherence to the Mediterranean diet, and tea and coffee drinking. The aforementioned relationships among MAP, PP, and different sociodemographic and bioclinical factors, especially among older adults in the Mediterranean basin, have rarely been studied.

Older hypertensive subjects in the Mediterranean basin were more likely to be obese, diabetic, hypercholesterolemic, and less physically active in the analyzed multinational dataset of the MEDIS study. All the aforementioned clinical and lifestyle factors are well-known determinants of abnormal arterial BP.[9] Possible mechanisms of the aforementioned clinical factors (such as obesity and diabetes) among hypertensive subjects might be attributable to the pathobiological pathway of insulin resistance, sympathetic nervous system activation, and systemic inflammatory molecules or leptin levels.[23,24]

Multi-adjusted analysis revealed an inverse association between adherence to the Mediterranean diet and the presence of hypertension among older adults. Strong, inverse associations between the Mediterranean diet and hypertension in the Mediterranean basin have been previously reported from investigations studying middle-aged populations.[9,25] The Mediterranean diet is highly protective throughout its variation of dietary components. Consumption of vegetables, fruits, olive oil (especially virgin olive oil), tree nuts, and walnuts is mainly responsible for the apparent protection against hypertension conveyed by the Mediterranean diet.[25–27] Moreover, intake of fermented alcoholic beverages is an important component of the Mediterranean diet, which is beneficially related to hypertension and abnormal BP levels.[20,28]

However, an inverse association between alcohol drinking of glasses per day and the likelihood of being hypertensive was found. In previous preliminary results of the MEDIS study (for only the Greek islands), a J-shaped association was observed between alcohol consumption and arterial BP levels.[29] According to a recent meta-analysis of 12 cohort studies,[12] a linear dose-response relationship was revealed in men (relative risk of 1.57 at 50 g of alcohol per day), whereas for women, a significant protective effect was reported for consumption at or below about 5 g/d, after which a similar linear dose-response relationship was observed. However, until now, dietary interventions to lower systolic and diastolic BP have been analyzed mainly in adults and to a lesser extent in older adults.[16,30]

Increased PP has been shown to promote the development of atherosclerosis[31,32] and may increase the likelihood of plaque rupture throughout the fatiguing effects of pulsatile strain.[33] Moreover, an independent association between PP and carotid artery disease[34] and small-vessel disease[35] has been described. PP is recognized as an independent determinant of CVD risk in middle-aged and older individuals.[7] MAP is another indicator of arterial BP and is associated with arterial blood volume and arterial and vessel compliance. For this reason, it is an indicator of multi-organ and tissue perfusion.[4] Abnormal levels of MAP are reported to affect peripheral resistance, which may produce changes in the length and diameter of vessels and changes in the vascular network.[4,36] Despite evidence regarding the beneficial effect of adherence to the Mediterranean diet and alcohol drinking and the presence of hypertension[9,25] and high levels of SBP and DBP,[16] information about their role in a wider spectrum of arterial BP such as MAP and PP is sparse, particularly so for the older population. Moreover, throughout the multinational MEDIS data analysis, the greater the adherence to the Mediterranean diet, the lower the levels of MAP. It may be speculated that the reduction of oxidative stress (anti-inflammatory effect) and the beneficial effect on lipid profiles and improvement in endothelial function[37,38] are the possible mechanisms of the favorable association between the Mediterranean diet and MAP.[39,40] Moreover, there was no association between MAP, PP, and alcohol drinking in our study. This lack of relationship could be attributed to the physiological hemodynamic nature (ie, steady flow load and pulsative load) of these indicators that differentiates them from the medical history of hypertension. However, clinical investigations have reported the beneficial association between alcohol consumption and improvement in postprandial endothelial function.[41,42]

Throughout the data analysis, heterogeneity in the determinants related to PP and MAP was found. However, this analysis revealed that obesity was the clinical factor that was consistently related to either the presence of hypertension or to an increase in the levels of PP and MAP. Obesity in older adults is a complex subject,[43] firstly because of the probable decline in the added risk for hypertension with increasing age, and secondly because of the paradoxical obesity consequences of hypertensive health in older adults.[23,44] As was recently outlined by the American Heart Association Professional Education Committee of the Council for High Blood Pressure Research, older age and obesity are two of the most powerful risk factors for the control of hypertension,[45] showing that obesity is a risk factor for hypertension in general, but also a risk factor for uncontrolled treated hypertension. Hypertension is quite complex,[46,47] and a variety of components other than the classical ones of BP could offer a broader image to increase understanding of the disease, especially among older individuals.[48]

STRENGTHS AND LIMITATIONS

The present study has several strengths. It is one of the few to evaluate the effect of various factors (clinical, sociodemographic, and lifestyle) on MAP and PP in a large sample of "healthy," independently living older individuals in the Mediterranean basin. Among the limitations of our study, the fact that it used a cross-sectional design limits the possibility for etiological conclusions. In addition, there is always a bias in self-reported questionnaires where drinkers underreport their alcohol consumption and hypertensive persons over-report it. Also, specific drinking patterns were not assessed. Another finding that may have been altered as a result of the cross-sectional nature of the study is for smoking habit, of which no significant association with BP measurements was observed, as expected (likely because older participants have modified their smoking habits not only because of age but also because of known comorbidities).

CONCLUSIONS

Greater adherence to the Mediterranean diet and moderate alcohol drinking appears to constitute a key point for public health preventive action. In addition, obesity seems to be a common risk factor for hypertension among older people, as well as for increased arterial resistance (MAP) and arterial stiffness (PP). Taking into account that treatment of hypertension constitutes a complex process, especially for older individuals,[48] in whom comorbidities exist, which includes many lifestyle changes, as well as special medication, promotion of healthy dietary habits close to the Mediterranean type of diet may constitute an effective, nonpharmacologic means for the management of BP levels as well as weight control.

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