Clinical Nutrition ESPEN 55 (2023) 144–150

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Original article

Dietary management of patients at high risk for cardiovascular disease; EUROASPIRE V

Pedro Marques-Vidal [a, *], Piotr Jankowski [b], Željko Reiner [c], Dirk De Bacquer [d], Kornelia Kotseva [e, f], on behalf of the EUROASPIRE EUROASPIRE V collaborators[1]

[a] Department of Medicine, Internal Medicine, Lausanne University Hospital and University of Lausanne, 46 rue du Bugnon, 1011 Lausanne, Switzerland
[b] Department of Internal Medicine and Geriatric Cardiology, School of Public Health, Centre of Postgraduate Medical Education, Warsaw, Poland
[c] Department of Internal Medicine, University Hospital Centre Zagreb, School of Medicine, University of Zagreb, Croatia
[d] Department of Public Health and Primary Care, Ghent University, Corneel Heymanslaan 10 (4K3), B-9000 Gent, Belgium
[e] National Institute for Prevention and Cardiovascular Health, National University of Ireland Galway, Republic of Ireland
[f] Imperial College Healthcare NHS Trust, London, UK

ARTICLE INFO

Article history:
Received 7 September 2022
Accepted 6 March 2023

Keywords:
Diet
Epidemiology
Primary prevention
Cardiovascular disease

SUMMARY

Background: Dietary prevention of cardiovascular risk factors is seldom implemented.
Aim: We assessed the dietary changes made by subjects at high risk of cardiovascular disease (CVD).
Design and setting: Cross-sectional, multicentre observational study (European Society of Cardiology - ESC EORP-EUROASPIRE V Primary Care) including 78 centres from 16 ESC countries.
Methods: Participants aged 18–79 years, devoid of CVD but treated with antihypertensive and/or lipid-lowering and/or antidiabetic therapy were interviewed >6 months and <2 years after medication initiation. Information regarding dietary management was collected by questionnaire.
Results: 2759 participants (overall participation rate 70.2%, 1589 women, 1415 aged ≥60 years, 43.5% with obesity, 71.1% on antihypertensive, 29.2% on lipid-lowering and 31.5% on antidiabetic treatment). Among participants with obesity, 47.7% reported having received dietary advice to lose weight [range: 24.7% (Greece) to 71.8% (Lithuania)]. Among participants on antihypertensive drug therapy, 53.9% reported being on a blood pressure lowering diet [range: 5.6% (UK) to 90.4% (Greece)]; a reduction of salt intake in the last three years was reported by 71.4% [range: 12.5% (Sweden) to 89.7% (Egypt)]. Among participants on lipid-lowering therapy, 56.0% reported being on a lipid lowering diet [range: 7.1% (Sweden) to 90.3% (Egypt)]. Among participants with diabetes, 57.2% reported being on a diet [range: 21.6% (Romania) to 95.1% (Bosnia & Herzegovina)]; a reduction in sugar intake was reported by 80.8% [range: 56.5% (Sweden) to 96.7% (Russian Federation)].
Conclusions: In ESC countries, fewer than 60% of participants at high CVD risk report being on a specific diet, with wide differences between countries.

1. Introduction

Cardiovascular risk factors such as hypertension, dyslipidaemia and diabetes are common in the general population, and their prevalence is increasing worldwide [1]. Hypertension and diabetes rank as first and third leading risk factors for disease worldwide, being responsible for over 15 million deaths [1]. All European guidelines stress the need for lifestyle changes among subjects presenting with cardiovascular risk factors, particularly changes in dietary behaviour [2–4]. Indeed, a healthy dietary pattern, in association with physical activity, has been shown to modestly reduce blood pressure, total cholesterol and risk of type 2 diabetes, making it an inexpensive method to manage cardiovascular risk factors. Still, many subjects with cardiovascular risk factors do not benefit from dietary counselling [5]. Further, despite cardiovascular disease (CVD) being one of the leading causes of mortality and morbidity in

* Corresponding author.
E-mail addresses: Pedro-Manuel.Marques-Vidal@chuv.ch (P. Marques-Vidal), PiotrJankowski@interia.pl (P. Jankowski), ZReiner@kbc-zagreb.hr (Ž. Reiner), Dirk.DeBacquer@UGent.be (D. De Bacquer), Kornelia.Kotseva@nuigalway.ie (K. Kotseva).
[1] A complete list of the EUROASPIRE V investigators is provided in Appendix 1.

https://doi.org/10.1016/j.clnesp.2023.03.005

Europe, there is a paucity of data related to dietary management of cardiovascular risk factors among European countries.

Therefore, we aimed to assess the dietary actions taken by subjects presenting with at least one of the main cardiovascular risk factors (hypertension, dyslipidaemia and diabetes) in a large sample of centres of European Society of Cardiology (ESC) countries, using data from the EURObservational Research Programme (EORP)-EUROASPIRE V study. Our hypothesis was that a significant fraction of the participants with cardiovascular risk factors would not change their dietary behaviours.

2. Method

2.1. Study setting

The primary care arm of EUROASPIRE V was carried out in 78 primary care centres in 16 countries: Bosnia & Herzegovina, Bulgaria, Croatia, the Czech Republic, Egypt, Greece, Kazakhstan, Kyrgyzstan, Lithuania, Poland, Portugal, Romania, Russian Federation, Sweden, Ukraine, and the United Kingdom during 2017–2018. Within each country, one or more geographical areas with a defined catchment area were selected and a sample of two or more general practices or health centres serving that population were identified according to the structure of the local health services. The list of the centres and investigators is provided in Appendix 1. Samples of 400 coronary patients who attended the interview are sufficient to estimate within-country prevalences with a precision of at least 5% and with a confidence of 95%. The precision of estimates after stratification for age and gender within a country was limited but combining data from all countries allowed precise estimates by age and gender. Detailed information regarding the methodology can be found in [6].

2.2. Inclusion criteria

Within each primary care centre, men and women aged between 18 and 79 years at the time of identification, without a history of CVD, who had been prescribed one or more of the following treatments: (i) antihypertensive drugs and/or (ii) lipid lowering drugs and/or (iii) glucose lowering (diet and/or oral drugs and/or insulin), ≥6 months up to <2 years prior to the date of interview, were identified retrospectively from records.

2.3. Dietary data

Information regarding dietary management was collected by a standardized questionnaire, which was translated in the different languages of the participating countries. The following information was collected: (1) presence of a special diet prescribed by a doctor or other health professional to lower blood pressure/cholesterol/manage diabetes and (2) adopted dietary actions over the last three years to reduce the risk of heart disease: reduction of calories/salt /fat/sugar/excessive alcohol intake; changing type of fat intake; eating more fruits and vegetables/fish/oily fish. Within each condition (i.e. obesity, hypertension …) the dietary interventions that are more related to it were considered (Supplementary Table 1).

2.4. Other covariates

Personal and demographic details were obtained from questionnaire [6]. Smoking at the time of interview was defined as self-reported smoking, and/or a breath carbon monoxide exceeding 10 ppm using a Smokerlyzer® Model Micro + (Bedfont Scientific, Harrietsham, Maidstone, UK).

Height and weight were measured in light indoor clothes without shoes using SECA scales 701 and stadiometer model 220 (SECA Medical Measuring Systems and Scales, Birmingham, UK). Obesity was defined as a body mass index (BMI) ≥30 kg/m^2.

2.5. Statistical analysis

Descriptive statistics were used to estimate the prevalence rates of dietary actions taken by the participants. Participants' demographics were described according to means, standard deviations and proportions. Statistical analyses were undertaken using SAS statistical software (release 9.4) in the Department of Public Health, Ghent University, Belgium, and Stata (Stata Inc, College Station, TX, USA, release 16.0) at the Lausanne University Hospital, Switzerland.

2.6. Ethical statement

National coordinators were responsible for obtaining the necessary approvals from local Ethics Committees. All protocols were approved by the local Ethics Committees and all participants provided written, informed consent before entering the study.

2.7. Data management

All data management was undertaken by the EORP Department of the ESC, according to the requirements defined by the appointed Executive Committee, with the support of the EORP Team. The database is located at the European Heart House, Sophia-Antipolis, France. All data was collected electronically using web-based data entry. Names were not sent to the data management centre where information is held on each subject using a unique identification number for country, centre and individual. All data was updated electronically by each country and submitted via the internet to the data management centre where checks for completeness, internal consistency and accuracy was run. All data is stored under the provisions of the National Data Protection Regulations.

3. Results

3.1. Characteristics of participants

Data from 2759 participants was included in the analysis. Their characteristics overall and according to centre are summarized in Table 1. Most (57.6%) participants were women; 51.3% of the participants were aged ≥60 years, 37.7% had higher education, 18.1% smoked, and 43.5% presented with obesity. The prevalence rates of women, highly educated participants, smoking or obesity varied considerably between countries/centres.

3.2. Dietary actions taken by participants with obesity

The dietary actions taken during the last three years by participants with obesity are summarized in Table 2. Overall, 47.7% of the participants reported being on a diet prescribed by a doctor or other health professional; 71.8% reported reducing fat and 69.6% reducing sugar intake; 62.0% reported consuming fewer calories, and 48.7% reported reducing excessive alcohol intake. Sweden had the lowest rates for all dietary actions, while Lithuania and the Czech Republic had the highest. Women reported less frequently having reduced excessive alcohol intake ($p = 0.029$), while participants aged ≥60 years reported less frequently being on a diet ($p = 0.004$), reducing calories ($p = 0.015$), sugar ($p = 0.049$), or excessive alcohol intake ($p = 0.006$).

Table 1
Characteristics of participants, EUROASPIRE V.

	N	Females (%)	Age (years)	Age ≥ 60 years (%)	Higher education (%)	Smoking (%)[a]	Body mass index (kg/m^2)	Obesity (%)[b]
All	2759	57.6%	59.0 ± 11.6	51.3%	37.7%	18.1%	29.8 ± 5.6	43.5%
Centre								
Bosnia & Herzegovina	190	58.9%	60.8 ± 10.9	57.9%	25.8%	20.0%	28.6 ± 4.1	33.2%
Bulgaria	171	53.2%	61.2 ± 11.1	62.6%	13.5%	21.6%	30.4 ± 5.8	44.4%
Croatia	203	55.2%	62.1 ± 10.2	61.6%	35.6%	24.6%	29.3 ± 5.3	39.4%
Czech Republic	84	48.8%	57.8 ± 14.2	48.8%	26.2%	25.0%	30.2 ± 5.8	46.4%
Egypt	162	60.5%	53.1 ± 11.8	28.4%	35.8%	14.2%	30.9 ± 6.3	53.4%
Greece	166	50.6%	62.8 ± 11.2	68.1%	1.8%	31.3%	30.8 ± 6.1	52.4%
Kazakhstan	200	65.5%	60.5 ± 8.7	56.5%	55.3%	18.5%	30.5 ± 5.5	45.5%
Kyrgyzstan	162	69.1%	55.8 ± 9.7	42.6%	38.8%	15.4%	30.3 ± 5.2	46.9%
Lithuania	201	62.2%	57.9 ± 10.1	45.3%	71.6%	21.4%	30.5 ± 5.5	50.7%
Poland	148	70.3%	51.9 ± 13.6	26.4%	43.5%	16.2%	26.3 ± 4.3	16.9%
Portugal	173	47.4%	64.7 ± 10.0	68.8%	12.7%	13.9%	29.4 ± 4.9	44.2%
Romania	198	58.1%	61.4 ± 11.1	61.1%	20.2%	9.6%	31.4 ± 6.5	54.5%
Russian Federation	200	59.0%	54.1 ± 11.5	34.5%	48.0%	27.5%	30.1 ± 5.5	47.5%
Sweden	78	47.4%	63.0 ± 10.6	64.1%	57.7%	5.1%	28.7 ± 4.8	29.5%
Ukraine	200	64.0%	57.5 ± 12.8	44.5%	68.5%	12.5%	29.5 ± 5.3	42.4%
United Kingdom	223	44.4%	59.8 ± 10.9	50.7%	40.4%	10.3%	29.3 ± 6.4	40.8%

[a] Self-reported smoking or CO in breath >10 ppm.
[b] body mass index ≥30 kg/m^2. Results are expressed as percentage or as mean ± standard deviation.

Table 2
Dietary management and actions taken during the last three years reported by participants with obesity at interview, EUROASPIRE V.

	Dietary advice[a]		Less calories[b]		Less fat[b]		Less sugar[b]		Less alcohol[b]	
	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI
All	1143	47.7 (44.8–50.6)	1162	62.0 (59.2–64.8)	1172	71.8 (69.2–74.4)	1177	69.6 (66.9–72.2)	1123	48.7 (45.7–51.7)
Centre										
Bosnia & Herzegovina	58	48.3 (35.0–61.8)	56	57.1 (43.2–70.3)	61	77.0 (64.5–86.8)	63	68.3 (55.3–79.4)	62	41.9 (29.5–55.2)
Bulgaria	75	50.7 (38.9–62.4)	76	61.8 (50.0–72.8)	76	65.8 (54.0–76.3)	76	63.2 (51.3–73.9)	76	26.3 (16.9–37.7)
Croatia	74	55.4 (43.4–67.0)	77	61.0 (49.2–72.0)	79	67.1 (55.6–77.3)	78	70.5 (59.1–80.3)	72	40.3 (28.9–52.5)
Czech Republic	39	56.4 (39.6–72.2)	39	82.1 (66.5–92.5)	39	79.5 (63.5–90.7)	39	69.2 (52.4–83.0)	39	74.4 (57.9–87.0)
Egypt	70	35.7 (24.6–48.1)	71	74.6 (62.9–84.2)	71	87.3 (77.3–94.0)	71	73.2 (61.4–83.1)	44	31.8 (18.6–47.6)
Greece	85	24.7 (16.0–35.3)	87	71.3 (60.6–80.5)	86	84.9 (75.5–91.7)	87	77.0 (66.8–85.4)	86	48.8 (37.9–59.9)
Kazakhstan	91	35.2 (25.4–45.9)	91	62.6 (51.9–72.6)	89	71.9 (61.4–80.9)	90	71.1 (60.6–80.2)	90	57.8 (46.9–68.1)
Kyrgyzstan	74	51.4 (39.4–63.1)	76	55.3 (43.4–66.7)	76	71.1 (59.5–80.9)	75	60.0 (48.0–71.1)	76	55.3 (43.4–66.7)
Lithuania	85	71.8 (61.0–81.0)	96	71.9 (61.8–80.6)	102	81.4 (72.4–88.4)	101	87.1 (79.0–93.0)	90	77.8 (67.8–85.9)
Poland	25	40.0 (21.1–61.3)	25	48.0 (27.8–68.7)	25	68.0 (46.5–85.1)	25	56.0 (34.9–75.6)	25	20.0 (6.8–40.7)
Portugal	73	53.4 (41.4–65.2)	75	60.0 (48.0–71.1)	74	70.3 (58.5–80.3)	75	77.3 (66.2–86.2)	73	56.2 (44.1–67.8)
Romania	108	44.4 (34.9–54.3)	107	57.9 (48.0–67.4)	108	72.2 (62.8–80.4)	108	63.9 (54.1–72.9)	107	27.1 (19.0–36.6)
Russian Federation	94	73.4 (63.3–82.0)	95	63.2 (52.6–72.8)	94	75.5 (65.6–83.8)	95	80.0 (70.5–87.5)	93	79.6 (69.9–87.2)
Sweden	23	26.1 (10.2–48.4)	23	39.1 (19.7–61.5)	23	26.1 (10.2–48.4)	23	43.5 (23.2–65.5)	23	4.3 (0.1–21.9)
Ukraine	79	43.0 (31.9–54.7)	78	53.8 (42.2–65.2)	79	59.5 (47.9–70.4)	82	68.3 (57.1–78.1)	78	55.1 (43.4–66.4)
United Kingdom	90	36.7 (26.8–47.5)	90	55.6 (44.7–66.0)	90	60.0 (49.1–70.2)	89	52.8 (41.9–63.5)	89	33.7 (24.0–44.5)
Gender										
Men	458	46.7 (42.1–51.4)	467	60.8 (56.2–65.3)	473	69.3 (65.0–73.5)	477	69.6 (65.3–73.7)	462	52.6 (47.9–57.2)
Women	685	48.3 (44.5–52.1)	695	62.9 (59.2–66.5)	699	73.5 (70.1–76.8)	700	69.6 (66.0–73.0)	661	46.0 (42.1–49.9)
P-value		0.597		0.477		0.118		0.991		0.029
Age at interview										
<60 years	549	52.1 (47.8–56.3)	559	65.7 (61.6–69.6)	565	74.2 (70.3–77.7)	564	72.3 (68.4–76.0)	532	53.0 (48.7–57.3)
≥60 years	594	43.6 (39.6–47.7)	603	58.7 (54.7–62.7)	607	69.7 (65.9–73.3)	613	67.0 (63.2–70.8)	591	44.8 (40.8–49.0)
P-value		0.004		0.015		0.089		0.049		0.006

[a] On a special diet prescribed by a doctor or other health professional to lower weight.
[b] positive answer to the questions "Over the last three years, which of the following steps did you take to reduce your risk of heart disease: reduction of calorie intake/reduction of fat intake/reducing sugar/reducing excessive alcohol intake". Results are expressed as number of responses, percentage and (95% confidence interval). Between gender and age group comparisons performed using chi-square test.

3.3. Dietary actions taken by participants using antihypertensive drugs

The dietary management and the dietary actions taken during the last three years by participants using antihypertensive drugs are summarized in Table 3. Overall, 53.9% of the participants reported being on a special diet prescribed by a doctor or other health professional, and 71.4% reported having reduced their salt intake. Sweden and the UK had the lowest rates for dietary management and action, while Egypt and Greece had the highest. Women reported more frequently a reduction in salt intake ($p = 0.007$), while participants aged ≥60 years reported more frequently being on a special diet ($p = 0.016$).

3.4. Dietary actions taken by participants using lipid-lowering drugs

The dietary management and the dietary actions taken during the last three years by participants using lipid-lowering drugs are summarized in Table 4. Overall, 56.0% of the participants reported being on a special diet prescribed by a doctor or other health professional; 76.0% reported having increased fruit and vegetable

Table 3
Dietary management and actions taken during the last three years by participants using antihypertensive drugs at interview, EUROASPIRE V.

	Special diet[a]		Less salt[b]	
	N	% and 95% CI	N	% and 95% CI
All	2105	53.9 (51.7–56.0)	2134	71.4 (69.4–73.3)
Centre				
Bosnia & Herzegovina	171	74.3 (67.0–80.6)	170	78.8 (71.9–84.7)
Bulgaria	166	84.3 (77.9–89.5)	167	77.2 (70.1–83.4)
Croatia	151	55.6 (47.3–63.7)	154	74.7 (67.0–81.3)
Czech Republic	70	30.0 (19.6–42.1)	70	58.6 (46.2–70.2)
Egypt	124	83.1 (75.3–89.2)	126	89.7 (83.0–94.4)
Greece	114	90.4 (83.4–95.1)	113	86.7 (79.1–92.4)
Kazakhstan	150	42.0 (34.0–50.3)	159	68.6 (60.7–75.7)
Kyrgyzstan	110	66.4 (56.7–75.1)	112	73.2 (64.0–81.1)
Lithuania	167	36.5 (29.2–44.3)	171	74.9 (67.7–81.2)
Poland	93	32.3 (22.9–42.7)	94	67.0 (56.6–76.4)
Portugal	146	54.1 (45.7–62.4)	146	80.1 (72.7–86.3)
Romania	185	67.6 (60.3–74.3)	186	76.9 (70.2–82.7)
Russian Federation	122	59.8 (50.6–68.6)	124	71.8 (63.0–79.5)
Sweden	63	7.9 (2.6–17.6)	64	12.5 (5.6–23.2)
Ukraine	149	26.8 (19.9–34.7)	154	56.5 (48.3–64.5)
United Kingdom	124	5.6 (2.3–11.3)	124	54.0 (44.9–63.0)
Gender				
Men	876	51.9 (48.6–55.3)	891	68.2 (65.1–71.3)
Women	1229	55.2 (52.4–58.1)	1243	73.6 (71.1–76.0)
P-value		0.143		0.007
Age at interview				
<60 years	968	51.0 (47.8–54.2)	981	69.8 (66.8–72.7)
≥60 years	1137	56.3 (53.3–59.2)	1153	72.7 (70.0–75.2)
P-value		0.016		0.146

[a] On a special diet prescribed by a doctor or other health professional to lower blood pressure.
[b] Positive answer to the question "Over the last three years, which of the following steps did you take to reduce your risk of heart disease: reduction of salt intake". Results are expressed as number of responses, percentage and (95% confidence interval). Between gender and age group comparisons performed using chi-square test.

intake; 70.4% reported having reduced their fat intake; 60.6% reported having changed the type of fat intake; 60.1% reported consuming more fish, and 44.0% reported consuming more oily fish. Sweden and Bulgaria had the lowest rates for most dietary actions, while Greece and Lithuania had the highest. Women reported more frequently having reduced their fat intake ($p = 0.038$), while participants aged ≥60 years reported more frequently consuming more oily fish ($p = 0.049$).

3.5. Dietary actions taken by participants with diabetes

The dietary management and the dietary actions taken during the last three years by participants treated for diabetes are summarized in Table 5. Overall, 57.2% of participants reported being on a special diet prescribed by a doctor or other health professional; 80.8% reported having reduced sugar intake; 77.6% reported increased fruit & vegetable intake; 76.5% reported having reduced fat, and 51.3% reported having reduced excessive alcohol intake. Sweden and the UK had the lowest rates for dietary management and most dietary actions, while Bosnia & Herzegovina and the Russian Federation had the highest. Women reported more frequently a reduction in fat intake ($p = 0.006$), while participants aged 60 years reported more frequently being on a special diet ($p = 0.010$) and having reduced sugar intake ($p = 0.025$).

4. Discussion

Our results suggest that (1) dietary management of cardiovascular risk factors is not systematically provided to subjects at high cardiovascular risk; (2) on average, fewer than 6 out of 10 participants at high cardiovascular risk report being on a specific diet, and (3) dietary management of cardiovascular risk factors is unevenly implemented in ESC countries, between genders and age groups. Still, the results related to the comparisons between genders or age groups should be interpreted with caution, as they are dependent on the sample size, gender and age distribution of the countries present. A country with a large sample where dietary recommendations are unevenly distributed between genders and/or age groups will have a larger influence in the overall result than a country with a small sample size and where dietary recommendations are provided to most patients.

4.1. Dietary actions taken by participants with obesity

Caloric reduction is part of obesity management [7]. In this study, less than half of participants with obesity reported to be on a special diet, suggesting that obesity is not considered seriously enough as an important CVD risk factor by physicians. Still, two thirds of participants with obesity reported having reduced their caloric intake, namely via a reduction of fat or sugar intake. These values are close to those reported in a previous EUROASPIRE registry (62.5% reduction in caloric intake and 74.7% reduction in fat intake) [8], suggesting that no major improvement of uptake of dietary measures occurred during the last years. One of the reasons might be that the general public perception of obesity as a CVD risk factor is relatively low, much lower than hypertension, elevated cholesterol, diabetes, family history, smoking and even low HDL-cholesterol [9]. Overall, our results indicate that obesity management in patients with CVD risk factors remains suboptimal, and that no improvement has occurred in the last years.

4.2. Dietary actions taken by participants using antihypertensive drugs

Salt reduction has been shown to decrease blood pressure levels [10]; on the population level, measures for salt reduction are beneficial and cost-effective for cardiovascular disease [11,12].

In this study, 53.9% of participants reported being on a special diet, and 71.4% reported having reduced their salt intake. These values are close to those reported in a previous EUROASPIRE registry (46.8% of participants on a special diet, and 73.3% reduction in salt intake) [8], suggesting that some improvements might have occurred regarding the dietary management of hypertension. The lower percentage of participants reporting a reduction of salt intake could be due to sampling or to the relatively complex messages regarding the effect of salt intake on blood pressure levels [13]. Overall, our results indicate that almost half of participants with hypertension do not appear to follow a diet aimed at reducing blood pressure levels.

4.3. Dietary actions taken by participants using lipid-lowering drugs

Increased fruit and vegetables intake has been suggested to have favourable effects on CVD risk factors [14]. Similarly, reducing saturated fat intake could reduce CVD risk [15], and a recent review concluded that increasing polyunsaturated fatty acids intake could reduce CHD mortality and stroke, but had no effect on CVD mortality [16]. In this study, 56% of participants reported being on a special diet, 70.4% reported consuming less fat, 76.0% reported consuming more fruits and vegetables, and 60.1% consuming more fish. These values are lower than those reported in a previous

Table 4
Dietary management and actions taken during the last three years by patients using lipid-lowering drugs at interview, EUROASPIRE V.

	Special diet[a]		Less fat[b]		Changing type of fat intake[b]		More F&V[b]		More fish[a]		More oily fish[a]	
	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI
All	922	56.0 (52.7–59.2)	929	70.4 (67.3–73.3)	907	60.6 (57.4–63.8)	932	76.0 (73.1–78.7)	924	60.1 (56.8–63.2)	907	44.0 (40.7–47.3)
Centre												
Bosnia & Herzegovina	65	84.6 (73.5–92.4)	61	88.5 (77.8–95.3)	58	66.7 (52.5–78.9)	62	85.5 (74.2–93.1)	57	70.2 (56.6–81.6)	58	50.0 (36.6–63.4)
Bulgaria	36	72.2 (54.8–85.8)	39	53.8 (37.2–69.9)	38	38.5 (23.4–55.4)	39	66.7 (49.8–80.9)	39	35.9 (21.2–52.8)	38	15.8 (6.0–31.3)
Croatia	84	72.6 (61.8–81.8)	84	71.4 (60.5–80.8)	76	63.1 (51.9–73.4)	82	81.7 (71.6–89.4)	79	62.0 (50.4–72.7)	76	51.3 (39.6–63.0)
Czech Republic	33	33.3 (18.0–51.8)	33	57.6 (39.2–74.5)	33	51.5 (33.5–69.2)	33	69.7 (51.3–84.4)	33	42.4 (25.5–60.8)	33	33.3 (18.0–51.8)
Egypt	31	90.3 (74.2–98.0)	31	87.1 (70.2–96.4)	31	67.7 (48.6–83.3)	31	54.8 (36.0–72.7)	31	35.5 (19.2–54.6)	31	32.3 (16.7–51.4)
Greece	91	85.7 (76.8–92.2)	95	81.1 (71.7–88.4)	95	70.8 (60.7–79.7)	96	84.4 (75.5–91.0)	96	74.0 (64.0–82.4)	95	54.7 (44.2–65.0)
Kazakhstan	13	76.9 (46.2–95.0)	13	76.9 (46.2–95.0)	13	69.2 (38.6–90.9)	13	76.9 (46.2–95.0)	13	61.5 (31.6–86.1)	13	46.2 (19.2–74.9)
Kyrgyzstan	6	33.3 (4.3–77.7)	6	66.7 (22.3–95.7)	6	66.7 (22.3–95.7)	6	83.3 (35.9–99.6)	6	83.3 (35.9–99.6)	6	16.7 (0.4–64.1)
Lithuania	60	45.0 (32.1–58.4)	62	80.6 (68.6–89.6)	60	78.3 (65.8–87.9)	63	85.7 (74.6–93.3)	63	76.2 (63.8–86.0)	60	75.0 (62.1–85.3)
Poland	76	39.5 (28.4–51.4)	77	58.4 (46.6–69.6)	77	53.9 (42.1–65.5)	76	65.8 (54.0–76.3)	77	53.2 (41.5–64.7)	77	16.9 (9.3–27.1)
Portugal	95	51.6 (41.1–62.0)	95	73.7 (63.6–82.2)	94	61.5 (51.0–71.2)	96	85.4 (76.7–91.8)	96	79.2 (69.7–86.8)	94	61.7 (51.1–71.5)
Romania	101	74.3 (64.6–82.4)	102	81.4 (72.4–88.4)	100	69.0 (59.0–77.9)	101	88.1 (80.2–93.7)	102	54.9 (44.7–64.8)	100	40.0 (30.3–50.3)
Russian Federation	31	67.7 (48.6–83.3)	31	80.6 (62.5–92.5)	31	74.2 (55.4–88.1)	31	74.2 (55.4–88.1)	31	74.2 (55.4–88.1)	31	67.7 (48.6–83.3)
Sweden	28	7.1 (0.9–23.5)	28	32.1 (15.9–52.4)	28	39.3 (21.5–59.4)	28	42.9 (24.5–62.8)	28	21.4 (8.3–41.0)	28	21.4 (8.3–41.0)
Ukraine	77	33.8 (23.4–45.4)	77	62.3 (50.6–73.1)	73	56.6 (44.7–67.9)	80	71.3 (60.0–80.8)	78	56.4 (44.7–67.6)	73	30.1 (19.9–42.0)
United Kingdom	95	15.8 (9.1–24.7)	95	54.7 (44.2–65.0)	94	42.6 (32.4–53.2)	95	62.1 (51.6–71.9)	95	51.6 (41.1–62.0)	94	42.6 (32.4–53.2)
Gender												
Men	428	52.8 (48.0–57.6)	431	67.1 (62.4–71.5)	421	57.9 (53.0–62.6)	432	74.8 (70.4–78.8)	430	60.7 (55.9–65.3)	421	43.9 (39.1–48.8)
Women	494	58.7 (54.2–63.1)	498	73.3 (69.2–77.1)	486	63.0 (58.6–67.3)	500	77.0 (73.1–80.6)	494	59.5 (55.0–63.9)	486	44.0 (39.6–48.6)
P-value		0.072		0.038		0.124		0.427		0.714		0.978
Age at interview												
<60 years	365	54.2 (49.0–59.4)	366	69.7 (64.7–74.3)	360	62.3 (57.0–67.3)	367	74.7 (69.9–79.0)	365	58.6 (53.4–63.7)	360	40.0 (34.9–45.3)
≥60 years	557	57.1 (52.9–61.2)	563	70.9 (66.9–74.6)	547	59.6 (55.4–63.7)	565	76.8 (73.1–80.2)	559	61.0 (56.8–65.1)	547	46.6 (42.4–50.9)
P-value		0.395		0.696		0.429		0.452		0.472		0.049

F&V = fruit & vegetables.
[a] On a special diet prescribed by a doctor or other health professional to lower blood cholesterol.
[b] Positive answer to the questions "Over the last three years, which of the following steps did you take to reduce your risk of heart disease: reduction of fat intake/changing type of fat intake/eating more fruit and vegetables". Results are expressed as number of responses, percentage and (95% confidence interval). Between gender and age group comparisons performed using chi-square test.

EUROASPIRE registry (60.3% of participants on a special diet, 76.2% reduction in fat intake, 80.3% increased fruit and vegetables intake and 64.7% increased fish intake) [8]. These differences could be due to differences in sampling or study sites. Nonetheless, they suggest an increasingly poor implementation of dietary measures to manage hyperlipidaemias. A possible explanation is that subjects with hyperlipidaemia prefer to take drugs rather than changing their dietary habits [17], although this statement has been challenged [18]. Overall, our results indicate that dietary management of hyperlipidaemia is suboptimal and appears to be worsening.

4.4. Dietary actions taken by participants with diabetes

Low glycaemic index or low glycaemic load diets have been shown to improve glycaemic control in diabetes [19], although this statement has also been challenged [20]. In this study, 57.2% of participants with diabetes reported dietary management. Those findings should be taken with caution, as a study reported a low adherence (<50%) to a dietary plan among patients with type 2 diabetes, and that among patients not following the dietary plan, 61.8% reported to stick to a self-made diet [21]. Hence, the effective adherence to a dietary plan aimed at preventing CVD among patients with diabetes might be rather low. This is probably one of the main reasons why the control of diabetes as a CVD risk factor in patients at high CVD risk remained poor between EUROASPIRE III and IV surveys as well [22].

Also, in this study, 80.8% of participants reported a decrease in sugar intake, 76.5% a decrease in fat intake, 77.5% an increase in fruit and vegetable intake, and 51.3% a reduction in alcohol intake. These values are slightly lower than those reported in EUROASPIRE IV registry (83.7% reduction in sugar intake, 77.1% reduction in fat intake, 81.1% increased fruit and vegetable intake and 57.4% reduced alcohol intake) [8]. Although comparisons are hampered by different recruitment centres, the results still suggest that dietary measures directed against diabetes have not been consistently implemented in ESC countries, a finding also reported in North America [23].

4.5. Implications for research and practice

Our results suggest that global measures aimed at increasing dietary management of CVD risk factors should be better implemented in some countries such as Sweden and the UK, which consistently ranked low regarding all dietary management and actions studied. As doctors are ill-trained regarding nutrition [24], the best approach would be the provision of dietary recommendations by nutritionists or dieticians.

Future research should focus on the provision of dietary recommendations by health professionals, and on the factors associated with poor uptake of dietary recommendations by patients. Given that dietary behaviours affect considerably more CVD than other noncommunicable diseases [25], it would be important that the current European dietary policies [26] be strengthened to reduce the current burden of CVD in Europe.

4.6. Strengths and limitations

This study has several strengths. Firstly, it relied on a standardized evaluation of the participants, thus enabling the comparison of findings between countries. Indeed, as dietary

Table 5
Dietary management and actions during the last three years in patients with self-reported diabetes, EUROASPIRE V.

	Dietary management[a]		Less fat[b]		Less sugar[b]		Less alcohol[b]		More F&V[b]	
	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI	N	% and 95% CI
All	979	57.2 (54.0–60.3)	971	76.5 (73.7–79.2)	981	80.8 (78.2–83.3)	931	51.3 (48.1–54.6)	981	77.5 (74.7–80.1)
Centre										
Bosnia & Herzegovina	61	95.1 (86.3–99.0)	58	82.8 (70.6–91.4)	61	83.6 (71.9–91.8)	60	61.7 (48.2–73.9)	60	85.0 (73.4–92.9)
Bulgaria	47	68.1 (52.9–80.9)	47	66.0 (50.7–79.1)	47	70.2 (55.1–82.7)	47	29.8 (17.3–44.9)	47	70.2 (55.1–82.7)
Croatia	69	55.1 (42.6–67.1)	67	76.1 (64.1–85.7)	67	83.6 (72.5–91.5)	62	43.5 (31.0–56.7)	69	81.2 (69.9–89.6)
Czech Republic	14	57.1 (28.9–82.3)	14	57.1 (28.9–82.3)	14	71.4 (41.9–91.6)	14	85.7 (57.2–98.2)	14	78.6 (49.2–95.3)
Egypt	88	64.8 (53.9–74.7)	88	84.1 (74.8–91.0)	88	85.2 (76.1–91.9)	58	20.7 (11.2–33.4)	88	50.0 (39.1–60.9)
Greece	117	53.8 (44.4–63.1)	116	81.0 (72.7–87.7)	117	70.9 (61.8–79.0)	117	29.9 (21.8–39.1)	117	83.8 (75.8–89.9)
Kazakhstan	127	57.5 (48.4–66.2)	127	79.5 (71.5–86.2)	127	81.1 (73.2–87.5)	127	69.3 (60.5–77.2)	128	78.9 (70.8–85.6)
Kyrgyzstan	73	54.8 (42.7–66.5)	76	75.0 (63.7–84.2)	76	80.3 (69.5–88.5)	77	54.5 (42.8–65.9)	77	87.0 (77.4–93.6)
Lithuania	52	42.3 (28.7–56.8)	51	86.3 (73.7–94.3)	52	86.5 (74.2–94.4)	44	75.0 (59.7–86.8)	50	90.0 (78.2–96.7)
Poland	33	84.8 (68.1–94.9)	33	72.7 (54.5–86.7)	33	72.7 (54.5–86.7)	33	48.5 (30.8–66.5)	33	72.7 (54.5–86.7)
Portugal	90	35.6 (25.7–46.3)	88	72.7 (62.2–81.7)	90	87.8 (79.2–93.7)	89	61.8 (50.9–71.9)	89	86.5 (77.6–92.8)
Romania	51	21.6 (11.3–35.3)	51	82.4 (69.1–91.6)	51	84.3 (71.4–93.0)	51	39.2 (25.8–53.9)	51	86.3 (73.7–94.3)
Russian Federation	60	68.3 (55.0–79.7)	60	86.7 (75.4–94.1)	60	96.7 (88.5–99.6)	59	88.1 (77.1–95.1)	60	76.7 (64.0–86.6)
Sweden	23	52.2 (30.6–73.2)	23	43.5 (23.2–65.5)	23	56.5 (34.5–76.8)	23	4.3 (0.1–21.9)	23	52.2 (30.6–73.2)
Ukraine	34	79.4 (62.1–91.3)	32	59.4 (40.6–76.3)	35	91.4 (76.9–98.2)	30	70.0 (50.6–85.3)	35	65.7 (47.8–80.9)
United Kingdom	40	45.0 (29.3–61.5)	40	60.0 (43.3–75.1)	40	67.5 (50.9–81.4)	40	32.5 (18.6–49.1)	40	70.0 (53.5–83.4)
Gender										
Men	433	56.4 (51.5–61.1)	430	72.3 (67.8–76.5)	433	81.3 (77.3–84.9)	420	53.1 (48.2–58.0)	432	77.5 (73.3–81.4)
Women	546	57.9 (53.6–62.1)	541	79.9 (76.2–83.2)	548	80.5 (76.9–83.7)	511	49.9 (45.5–54.3)	549	77.4 (73.7–80.8)
P-value		0.632		0.006		0.746		0.332		0.961
Age at interview										
<60 years	389	62.2 (57.2–67.0)	388	78.6 (74.2–82.6)	389	84.3 (80.3–87.8)	360	54.7 (49.4–59.9)	391	76.7 (72.2–80.8)
≥60 years	590	53.9 (49.8–58.0)	583	75.1 (71.4–78.6)	592	78.5 (75.0–81.8)	571	49.2 (45.0–53.4)	590	78.0 (74.4–81.2)
P-value		0.010		0.210		0.025		0.101		0.649

F&V, fruit & vegetables.
[a] On a special diet prescribed by a doctor or other health professional.
[b] Positive answer to the question "Over the last three years, which of the following steps did you take to reduce your risk of heart disease: reduction of fat intake/reduction of sugar intake/reducing excessive alcohol intake/eating more fruit and vegetables". Results are expressed as number of responses, percentage and (95% confidence interval). Between gender and age group comparisons performed using chi-square test.

recommendations may vary considerably between countries and patients might not know the name of diet they are following (i.e., DASH, Mediterranean), we applied generic questions to ensure comparability of the answers. Second, it included a wide number of countries, thus enabling local stakeholders to use the results as reference for future studies or as benchmark for implementation policies. Finally, the results were based on a large sample.

This study also has several limitations. Firstly, the participating centres cannot be considered as representative of the entire country, and a selection bias towards overestimation of the rates of dietary management or dietary actions taken is likely. Hence, the actual European panorama regarding the dietary management of CVD risk factors might be worse than reported. Secondly, the questions in this survey focused on changes that had occurred within the last three years, and it is possible that an inaccurate recall may be present, participants remembering better the more recent recommendations provided. Thirdly, due to the complexity of recruitment settings and the paucity of validated dietary assessment instruments, it was not possible to evaluate in detail the dietary intake of the participants at different time points. Fourthly, it was not possible to assess whether the changes reported actually did take place; thus, over-reporting cannot be excluded and it is likely that the changes are actually less frequent. Fifthly, due to the large differences in health systems, a side-by-side comparison of countries would be inadequate; still, the provision of confidence intervals will enable the reader to make his/her own comparisons. Sixthly, some participating centres changed between EUROASPIRE surveys; hence, assessment of trends is difficult. Finally, the information collected was reported by the participants and not by their families or informal carers. Hence, it is possible that the provision of dietary recommendations might be higher than reported, although most studies suggest that nutritional knowledge of doctors is low [24].

5. Conclusion

We conclude that (1) fewer than 6 out of 10 participants at high cardiovascular risk report being on a specific diet, and (2) dietary management of cardiovascular risk factors is unevenly implemented in different ESC countries/centres.

Funding

The EUROASPIRE V survey was carried out under the auspices of the European Society of Cardiology, EURObservational Research Programme (EORP). The survey was supported through research grants to the European Society of Cardiology from Amarin, Amgen, Daiichi Sankyo, Eli Lilly, Ferrer, Novo Nordisk, Pfizer, and Sanofi. The sponsors of the EUROASPIRE surveys had no role in the design, data collection, data analysis, data interpretation, decision to publish, or writing the manuscript.

Declaration of Helsinki

The authors declare that their study complies with the Declaration of Helsinki, that the locally appointed ethics committee has approved the research protocol and that informed consent has been obtained from the subjects (or their legally authorized representative).

Author contribution

The authors had full access to the data and took responsibility for its integrity. All authors have read and agreed to the written manuscript. **Pedro Marques-Vidal:** Conceptualization, Methodology, Writing – Original draft preparation; Visualization. **Dirk De Bacquer:** Investigation, data curation, formal analysis. **Kornelia**

Kotseva: Funding acquisition, resources, writing – reviewing and editing; **Piotr Jankowski and Željko Reiner:** Resources, writing – reviewing and editing.

Disclaimer

The views expressed in the submitted article are the author's own and not an official position of the institution or funder.

Declaration of competing interest

Kornelia Kotseva reports a grant from the ESC to the Imperial College London for the central co-ordination of EUROASPIRE V. The other authors report no relationships that could be construed as a conflict of interest.

Acknowledgements

The Registry Executive Committee and Steering Committee of the EURObservational Research Programme (EORP). Data collection was conducted by the EORP department of the ESC, by Thierry Ferreira, Hervé Druais and Céline Arsac as EORP Team Managers, Myraim Glémot, Katell Lemaître and Emanuela Fiorucci as Project Officers, Rachid Mir Hassaine and Clara Berle as Clinical Project Managers and Viviane Missiamenou, Florian Larras and Gagan Chhabra as Data Managers. All investigators are listed in the Appendix.

The ESC EORP-EUROASPIRE V Primary Care Study Group is grateful to the administrative staff, physicians, nurses, and other personnel in the hospitals in which the survey was carried out and to all patients who participated in the surveys.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2023.03.005.

References

[1] G. B. D. Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet (London, England) 2018;392:1923–94.
[2] Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J 2018;39:3021–104.
[3] Cosentino F, Grant PJ, Aboyans V, Bailey CJ, Ceriello A, Delgado V, et al. 2019 ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD. Eur Heart J 2020;41:255–323.
[4] Mach F, Baigent C, Catapano AL, Koskinas KC, Casula M, Badimon L, et al. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. Eur Heart J 2020;41:111–88.
[5] Grange M, Mayen AL, Guessous I, Waeber G, Vollenweider P, Marques-Vidal P. Lost in translation: dietary management of cardiovascular risk factors is seldom implemented. Prev Med 2015;76:68–73.
[6] Kotseva K, De Backer G, De Bacquer D, Ryden L, Hoes A, Grobbee D, et al. Primary prevention efforts are poorly developed in people at high cardiovascular risk: a report from the European Society of Cardiology EURObservational Research Programme EUROASPIRE V survey in 16 European countries. Eur J Prev Cardiol 2021;28:370–9.
[7] Smethers A, Rolls B. Dietary management of obesity: cornerstones of healthy eating patterns. Med Clin 2018;102:107–24.
[8] Kotseva K, De Bacquer D, De Backer G, Ryden L, Jennings C, Gyberg V, et al. Lifestyle and risk factor management in people at high risk of cardiovascular disease. A report from the European Society of Cardiology European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE) IV cross-sectional survey in 14 European regions. Eur J Prev Cardiol 2016;23:2007–18.
[9] Reiner Z, Sonicki Z, Tedeschi-Reiner E. Public perceptions of cardiovascular risk factors in Croatia: the PERCRO survey. Prev Med 2010;51:494–6.
[10] Graudal NA, Hubeck-Graudal T, Jurgens G. Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride. Cochrane Database Syst Rev 2017;4:CD004022.
[11] Yin X, Rodgers A, Perkovic A, Huang L, Li KC, Yu J, et al. Effects of salt substitutes on clinical outcomes: a systematic review and meta-analysis. Heart 2022;108:1608–15.
[12] Jorgensen T, Capewell S, Prescott E, Allender S, Sans S, Zdrojewski T, et al. Population-level changes to promote cardiovascular health. Eur J Prev Cardiol 2013;20:409–21.
[13] Mente A, O'Donnell M, Rangarajan S, Dagenais G, Lear S, McQueen M, et al. Associations of urinary sodium excretion with cardiovascular events in individuals with and without hypertension: a pooled analysis of data from four studies. Lancet (London, England) 2016;388:465–75.
[14] Hartley L, Igbinedion E, Holmes J, Flowers N, Thorogood M, Clarke A, et al. Increased consumption of fruit and vegetables for the primary prevention of cardiovascular diseases. Cochrane Database Syst Rev 2013:CD009874.
[15] Hooper L, Martin N, Abdelhamid A, Davey Smith G. Reduction in saturated fat intake for cardiovascular disease. Cochrane Database Syst Rev 2015:CD011737.
[16] Abdelhamid AS, Martin N, Bridges C, Brainard JS, Wang X, Brown TJ, et al. Polyunsaturated fatty acids for the primary and secondary prevention of cardiovascular disease. Cochrane Database Syst Rev 2018;11:CD012345.
[17] Sugiyama T, Tsugawa Y, Tseng CH, Kobayashi Y, Shapiro M. Different time trends of caloric and fat intake between statin users and nonusers among US adults: gluttony in the time of statins? JAMA Intern Med 2014;174:1038–45.
[18] Gadowski AM, Nanayakkara N, Heritier S, Magliano DJ, Shaw JE, Curtis AJ, et al. Association between dietary intake and lipid-lowering therapy: prospective analysis of data from Australian Diabetes, Obesity, and Lifestyle study (AusDiab) using a quantile regression approach. Nutrients 2019;11.
[19] Thomas D, Elliott E. Low glycaemic index, or low glycaemic load, diets for diabetes mellitus. Cochrane Database Syst Rev 2009:CD006296.
[20] Korsmo-Haugen HK, Brurberg KG, Mann J, Aas A. Carbohydrate quantity in the dietary management of type 2 diabetes: a systematic review and meta-analysis. Diabetes Obes Metabol 2019;21:15–27.
[21] Ponzo V, Rosato R, Tarsia E, Goitre I, De Michieli F, Fadda M, et al. Self-reported adherence to diet and preferences towards type of meal plan in patient with type 2 diabetes mellitus. A cross-sectional study. Nutr Metabol Cardiovasc Dis 2017;27:642–50.
[22] De Backer G, De Bacquer D, Ryden L, Kotseva K, Gaita D, Georgiev B, et al. Lifestyle and risk factor management in people at high cardiovascular risk from Bulgaria, Croatia, Poland, Romania and the United Kingdom who participated in both the EUROASPIRE III and IV primary care surveys. Eur J Prev Cardiol 2016;23:1618–27.
[23] Leiter LA, Berard L, Bowering CK, Cheng AY, Dawson KG, Ekoe JM, et al. Type 2 diabetes mellitus management in Canada: is it improving? Can J Diabetes 2013;37:82–9.
[24] Crowley J, Ball L, Hiddink GJ. Nutrition in medical education: a systematic review. Lancet Planet Health 2019;3:e379–89.
[25] Collaborators GBDD. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet (London, England) 2019;393:1958–72.
[26] Pineda E, Poelman MP, Aaspollu A, Bica M, Bouzas C, Carrano E, et al. Policy implementation and priorities to create healthy food environments using the Healthy Food Environment Policy Index (Food-EPI): a pooled level analysis across eleven European countries. Lancet Reg Health Eur 2022;23:100522.

Appendix 1
EUROASPIRE V registry (EAV) Primary care

EORP Oversight Committee

2014-2016: R. Ferrari, IT (Chair); A. Alonso, ES; J. Bax, NL; C. Blomström-Lundqvist, SE; S. Gielen, DE; P. Lancellotti, BE; A.P. Maggioni, IT; N. Maniadakis, GR; F. Pinto, PT; F. Ruschitzka, CH; L. Tavazzi, IT; P. Vardas, GR; F. Weidinger, AT; U. Zeymer, DE. **2016-2018**: A. Vahanian, FR (Chair); A. Budaj, PL; N. Dagres, DE; N. Danchin, FR; V. Delgado, NL; J. Emberson, GB; O. Friberg, SE; C.P. Gale, GB; G. Heyndrickx, BE; B. Iung, FR; S. James, SE; A.P. Kappetein, NL; A.P. Maggioni, IT; N. Maniadakis, GR; K.V. Nagy, HU; G. Parati, IT; A-S. Petronio, IT; M. Pietila, FI; E. Prescott, DK; F. Ruschitzka, CH; F. Van de Werf, BE; F. Weidinger, AT; U. Zeymer, DE. **2018-2020**: C.P. Gale, GB (Chair); B. Beleslin, RS; A. Budaj, PL; O. Chioncel, RO; N. Dagres, DE; N. Danchin, FR; J. Emberson, GB; D. Erlinge, SE; M. Glikson, IL; A. Gray, GB; M. Kayikcioglu, TR; A.P. Maggioni, IT; K.V. Nagy, HU; A. Nedoshivin, RU; A-P. Petronio, IT; J.W. Roos-Hesselink, NL; L. Wallentin, SE; U. Zeymer, DE. **2020-2022**: B.A. Popescu, RO (Chair); D. Adlam, GB; A.L.P. Caforio, IT; D. Capodanno, IT; M. Dweck, GB; D. Erlinge, SE; M. Glikson, IL; J. Hausleiter, DE; B. Iung, FR; M. Kayikcioglu, TR; P. Ludman, GB; L. Lund, SE; A.P. Maggioni, IT; S. Matskeplishvili, RU; B. Meder, DE; K.V. Nagy, HU; A. Nedoshivin, RU; D. Neglia, IT; A.A. Pasquet, BE; J.W. Roos-Hesselink, NL; F.J. Rossello, ES; S.M. Shaheen, EG; A. Torbica, IT.

Steering Committee (Executive Committee and National Coordinators)
I Executive Committee
Kornelia Kotseva, GB (Chair EUROASPIRE V Steering Committee); Guy De Backer, BE (Chair EUROASPIRE V Executive Committee); Dirk De Bacquer, BE; Diederick E. Grobbee, NL; Arno W. Hoes, NL; Aldo P. Maggioni, IT; Pedro Marques-Vidal, CH; Lars Rydén, SE; David A. Wood, GB

II National Coordinators
Ana Abreu, PT; Carlos Aguiar, PT; Jolita Badariene, LT; Jan Bruthans, CZ; Almudena Castro Conde, ES; Renata Cifkova, CZ; Jim Crowley, IE; Kairat Davletov, KZ; Delphine De Smedt, BE; Johan De Sutter, BE; Jaap W. Deckers, NL; Mirza Dilic, BA; Vilnis Dzerve, LV; Maryna Dolzhenko, UA; Andrejs Ērglis, LV; Zlatko Fras, SI; Dan Gaita, RO; Nina Gotcheva, BG; Hosam Hasan-Ali, EG; Peter Heuschmann, DE; Piotr Jankowski, PL; Nebojsa Lalic, RS; Seppo Lehto, FI; Christos Lionis, GR; Dragan Lovic, RS; Aldo P. Maggioni, IT; Silvia Mancas, RO; Davor Miličić, HR; Erkin Mirrakhimov, KG; Rafael Oganov, RU; Nana Pogosova, RU; Željko Reiner, HR; Lars Ryden, SE; Stefan Störk, DE; Lale Tokgözoğlu, TR; Konstantinos Tsioufis, GR; Dusko Vulic, BA; David A. Wood, GB.

Coordinating centre

Agnieszka Adamska, GB; Sabina Adamska, GB; Catriona Jennings, GB; Kornelia Kotseva, GB; David A. Wood GB;

Diabetes centre

Viveca Gyberg, SE; Linda Mellbin, SE; Oliver Schnell, DE; Lars Rydén, SE; Jaakko Tuomilehto, FI;

Statistical analysis centre

Dirk De Bacquer,BE; Guy De Backer, BE

Central laboratory

Laura Raman, FI; Jouko Sundvall, FI

Investigators

Bosnia & Herzegovina: *Sarajevo*: A. Begic, M. Dilic, Z. Jatic , A. Keco, A. Osmanagic, N. Trifunovic, Banja Luka: D. Vulic, *Banja Luka*: D. Djekic, *Banja Luka*: M. Popovic, G. Tesanovic, *Banja Luka*: N. Todorovic, *Banja Luka*: K. Stanetic, *Banja Luka*: V. Petrovic, *Banja Luka*: N. Pilipovic-Broceta, *Banja Luka*: B. Djukic, *Banja Luka*: B. Milankovic, *Banja Luka*: S. Savic; **Bulgaria:** *Sofia*: B. Georgiev, N. Manova, N. Gotcheva, A. Terziev, G. Vladimirov, *Sofia*: T. Doychinova, M. Nikolova, *Varna:* S. Doncheva, S. Ivanova, B. Kanazirev, S. Nikolaeva, D. Tonkova, M. Vetkova; **Croatia** *Zagreb*: D. Milicic, Z. Reiner, J. Samardzic; *Zagreb:* V. Cerovecki, I. Kermc, *Zagreb*: Z. Ozvacic Adzic, *Zagreb:* G. Petricek, *Zagreb*: M. Hanzevacki, *Zagreb:* K. Kranjcevic, *Zagreb:* I. Jukic-Vojnic, *Zagreb*: I. Pecek, *Zagreb:* N. Buljan, *Zagreb:* V. Bralic Lang; **Czech Republic:** *Prague*: J. Bruthans, R. Cífková, Z. Petržílková, P. Šulc, *Prague*: P. Herle, *Prague*: M Kerner; **Egypt:** *Assiut*: K. Elmaghraby, H. B. Hamed, H. Hasan-Ali, N. Mohamed, E. Mosad *Aswan*: A. Ibrahim, M. A. Elsharef, E. F. Kholef**,** *Cairo*: A. Elamragy, A. Youssef, *Zagazig*: T. M. Moustafa, M. S. Sobieh; **Greece:** *Heraklion Crete*: C. Lionis, *Heraklion Crete*: T. Vasilopoulos, D. Vasilakis, I. Trachanatzi, *Heraklion Crete*: F. Anastasiou, G. Duijker, K. Moschou, M. Titaki, **Kazakhstan**: *Almaty*: B. Assembekov, B. Amirov, S. Berkinbaev, Y. Chernokurova, K. Davletov, F. Ibragimova**,** *Almaty*: N. Ermekkyzy, N. Chektikbaeva, G. Aldibekova**,** *Almaty*: Z. Ayekeshov**,** *Almaty*: A. Smagulova, S. Kenebaeva, F. Zaureshbekova**,** *Almaty*: F. Umarova, M. Zhumakun, K. Erlanova**,** *Almaty*: K. Aitkazina**,** *Almaty*: G. Nurmagambetova; **Kyrgyzstan**: *Bishkek*: E. Hodzhiboboev, E. Mirrakhimov, K. Neronova, U. Zakirov, *Bishkek*: S. Abilova, E. Bektasheva, J. Esenbekova, A. Turusbekova**,** *Osh:* A. Kerimkulova, J. Turganbaeva, U. Toktomamatov, A. Asanbaev, R. Arapova, *Osh*: O. Lunegova, K. Ergeshova, N. Asanaliev, N. Mamasydykova; **Lithuania**: *Vilnius*: J. Badarienė, L. Vencevičienė, I. Eitaviciute, K.

Vencevicius, *Kaunas:* G. Urbonas, I. Valciukaite, L. Petrauskas, J. Karpaviciene, G. Lazarenkiene; **Poland**: *Krakow*: D. Czarnecka, P. Jankowski, *Bydgoszcz*: A. Andruszkiewicz, K. Buczkowski, A. Kubica, A. Kosobucka, P. Michalski, Ł. Pietrzykowski, *Bydgoszcz*: D. Borowska, P. Michalski, Ł. Pietrzykowski, *Łódź*: A. Kubica, P. Michalski M. Timler; **Portugal***: Lisboa Norte*: A. Abreu, *Lisboa Ocidental*: C. Aguiar, *Sacavém*: P. Brás, A. Castelo, M. Cruz, V. Ferreira, A. Gonçalves, T. Mano, T. Mendonça, L. Morais, R. Moreira, J. Pereira, R. Pires, J. Reis, I. Rodrigues, J. Sanches, C. Silva, H. Tiny, *Oeiras*: C. Brízido, A. Félix de Oliveira, F. Fernandes da Gama, M. Gonçalves, G. Mendes, M. H. Febra, A. S. Figueira, M. Chen, A. Oliveira, C. Ferreira, J. Sanches, R. Sanches; **Romania**: *Timisoara*: D. Baibata, L. Bizau, O. Cosor, L. Craciun, L. Gaita, D. Gaita, S. Mosteoru, *Iasi:* F. Mitu, R. S. Gavril, O. Mitu; **Russian Federation**: *Moscow*: A. Arutyunov, A. Ausheva, T. Gusarova, S. Isakova, A. Karpova, I. Lelchuk, N. Pogosova, A. Salbieva, O. Sokolova, Y. Yufereva, *Moscow*: A. Allenov, S. Strelkova, Moscow: I. Polunina, *Moscow:* O. Krasilnikova, I. Korzhenevskaya, *Moscow:* E. Kasparova, M. Shebzukhova, *Barnaul*: I. Osipova, O. Antropova, L. Borisova, N. Pyrikova, I. Polyakova; **Sweden:** *Stockholm*: V. Gyberg, L. Rydén, S. Smetana, V. Boström-Nilsson**,** *Stockholm*: P. Papachristou, *Lindingo*: L. Forsell, *Danderyd*: V. Gyberg, *Vallentuna*: M. Murén; *Stockholm*: S. Skeppholm, *Hasselby:* P. Löf; **Ukraine:** Kiev: M. Dolzhenko, C. Faradj, L. Grybyak, L. Konoplyanik, N. Kozhuhareva, L. Lobach, T. Mostepan, O. Nudchenko, T. Simagina, V. Tkachenko, L. Yakovenko, *Kharkiv:* S. Serik, T. Ovrakh**;** *Lviv*: A. Bazylevych, M. Bazylevych**,** *Kryvyj Rig*: V. Potabashniy, V. Fesenko, V. Asarenko**,** *Dnipro*: T. Kolesnyk, H. Kosova, A. Nadiuk, *Zaporizhzhya:* O. Shershnyova, L. Panchenko; **United Kingdom***: London*: A. Adamska, S. Adamska; C. Jennings, K. Kotseva, D. Wood, *London*: F. Doyle, S. Shillito, M. Zerominska**,** Harrow: I. Khan, R. Coles, N. Coote, P. Griffiths, O. Hussein, B. Joseph**,** *West Midlands*: A. Ballintine, A. Isaew, S. Spannuth, J. Timmins, S. Uddin; *Birmingham*: J. Taylor; *Stirchley*: N. Chauhan, *West Midlands*: A. Agasou, L. Andrew, R. Hibbell, S. Hollishead, J. Howell, S. Hunt, S. Jones, S. Mazilu-Wood, M. Oakley, L. Rosenberg, J. Simm, C. Thornley, J. Wilson, *Oswestry*: M. Arthur, *Oswestry*: T. Nguyen**,** *Oswestry:* C. Bell, *West Midlands*: C. Brown, J. Davies, N. Ghuman, C. Talbot, *Kenilworth*: R. Crowe, *Worcester:* C. Jones, *East Midlands*: J. Beecham, S. Bosel-Doyle, K. Duff, *Bourne*: L. S. Taylor, T. Mason, *Gainsborough:* S. Taylor, P. Steadman

Supplementary information

Supplementary table 1: questionnaire on healthy diet, ESC-EORP EUROASPIRE V study.

Q28a. OVER THE LAST THREE YEARS, were you offered any <u>PERSONAL ADVICE</u> by a doctor or other health care professional on the following			
Healthy diet **- reduction of salt intake:**	☐ No	☐ Yes	☐ Unsure/ Don't know
- reduction of fat intake:	☐ No	☐ Yes	☐ Unsure/ Don't know
- changing type of fat intake:	☐ No	☐ Yes	☐ Unsure/ Don't know
- reduction of calorie intake:	☐ No	☐ Yes	☐ Unsure/ Don't know
- eating more fruits and vegetables:	☐ No	☐ Yes	☐ Unsure/ Don't know
- eating more fish:	☐ No	☐ Yes	☐ Unsure/ Don't know
- eating more oily fish:	☐ No	☐ Yes	☐ Unsure/ Don't know
- reducing sugar:	☐ No	☐ Yes	☐ Unsure/ Don't know
- reducing excessive alcohol intake:	☐ No	☐ Yes	☐ Unsure/ Don't know

Supplementary table 2: dietary interventions considered for each cardiovascular risk factor, ESC-EORP EUROASPIRE V study

Risk factor	Dietary information
Obesity	reduction of fat intake
	reduction of calorie intake
	reducing sugar
	reducing excessive alcohol intake
Hypertension	reduction of salt intake
Dyslipidemia	reduction of fat intake
	changing type of fat intake
	eating more fruits and vegetables
	eating more fish
	eating more oily fish
Diabetes	reduction of fat intake
	reducing sugar
	reducing excessive alcohol intake
	eating more fruits and vegetables