



Taste it, enjoy it. it's olive oil.

| 24

MADRID, SPAIN
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#alimentosdespaña

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Olive Oil in modern Mediterranean diet

Madrid, June 28, 2024

Miguel A. Martínez-González, MD, PhD, MPH

Conflicts of interest

Nothing to disclose



The NEW ENGLAND JOURNAL of MEDICINE

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JUNE 26, 2003

VOL. 348 NO. 26

Adherence to a Mediterranean Diet and Survival in a Greek Population

Antonia Trichopoulou, M.D., Tina Costacou, Ph.D., Christina Bamia, Ph.D., and Dimitrios Trichopoulos, M.D.



9-item MedDiet score

• 1 point if $\geq$ median

1. MUFA/SFA ratio
2. Fruits & tree nuts
3. Vegetables
4. Cereals
5. Legumes
6. Fish

• 1 point if $\leq$ median

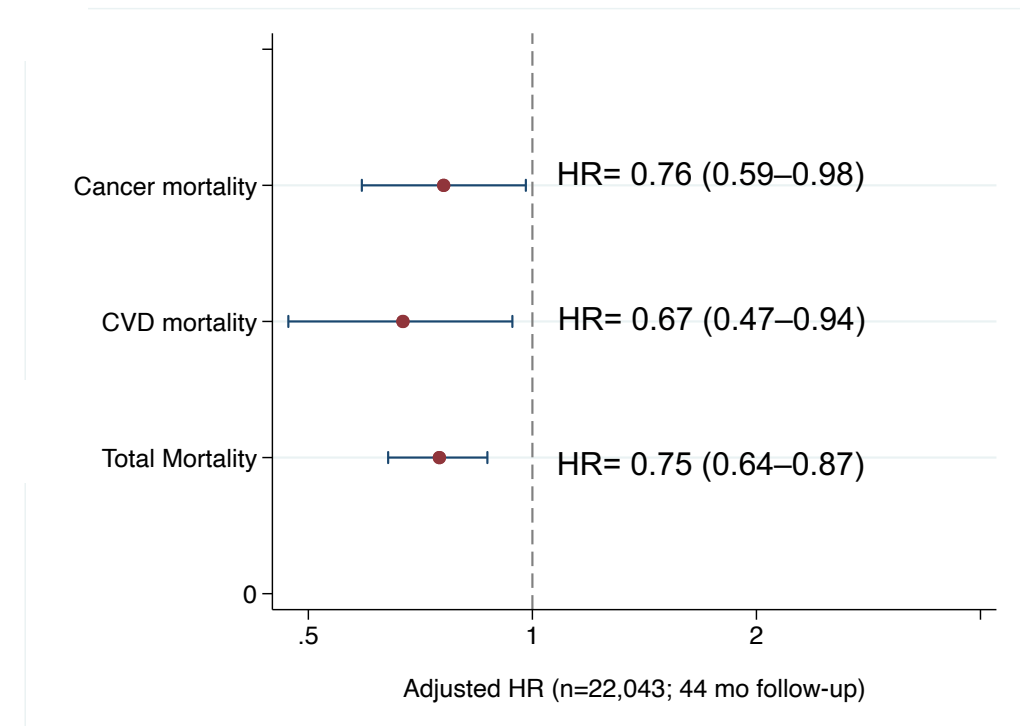
7. Meats / meat products
8. Dairy

9. Alcohol: 1 point if

- Men: 10-50 g/d
- Women: 5-25 g/d



Hazard Ratios(95% CI) per +2 point



A Short Screener Is Valid for Assessing Mediterranean Diet Adherence among Older Spanish Men and Women¹⁻³

Helmut Schröder,^{4,5} Montserrat Fitó,^{4,5} Ramón Estruch,^{5,6} Miguel A. Martínez-González,⁸

3+2

1

3/wk

J Nutr 2011;141:1140

4



3/wk



nutrients
 Article
Validation of the English Version of the 14-Item Mediterranean Diet Adherence Screener of the PREDIMED Study, in People at High Cardiovascular Risk in the UK
 Angeliki Papadaki^{1,2,*}, Laura Johnson¹, Zoi Tzoumpaki¹, Clare England^{1,2}, Manjula Rai¹, Stu Toms², Chris Penfold², Itziar Zazpe^{3,4}, Miguel A. Martínez-González^{4,5} and Gene Feder⁶

Mediterranean diet assessment challenges: Validation of the Croatian Version of the 14-Item Mediterranean Diet Serving Score (MDSS) Questionnaire.
 Marendić M, Polić N, Matek H, Oršulić L, Polasek O, Kokić L
 PLoS One. 2021 Mar 1;16(3):e0247269. doi: 10.1371/journal.pone.0247269. eCollection 2021.

Validation of the German version of the Mediterranean Diet Adherence Screener (MEDAS) questionnaire.
 Hebestreit K, Yahiaoui-Doktor M, Engel C, Vetter W, Siniatchkin M, Erickson N, Halle M, Kiechle M, Bischoff SC.
 BMC Cancer. 2017 May 18;17(1):341. doi: 10.1186/s12885-017-3337-y.
 PMID: 28521737 Free PMC Article



Translation and cross-cultural adaptation of 14-item Mediterranean Diet Adherence Screener and low-fat diet adherence questionnaire.
 Vieira LM, Gottschall CBA, Vinholes DB, Martinez-Gonzalez MA, Marcadenti A.
 Clin Nutr ESPEN. 2020 Oct;39:180-189. doi: 10.1016/j.clnesp.2020.06.018. Epub 2020 Jul 22.



Validation of the Telephone-Administered Version of the Mediterranean Diet Adherence Screener (MEDAS) Questionnaire.
 Gregório MJ, Rodrigues AM, Salvador C, Dias SS, de Sousa RD, Mendes JM, Coelho PS, Branco JC, Lopes C, Martínez-González MA, Graça P, Canhão H.
 Nutrients. 2020 May 22;12(5):1511. doi: 10.3390/nu12051511.



Exploring the Validity of the 14-Item Mediterranean Diet Adherence Screener (MEDAS): A Cross-National Study in Seven European Countries around the Mediterranean Region.
 García-Conesa MT, Philippou E, Pafitis C, Massaro M, Quarta S, Andrade V, Jorge R, Chervenkov M, Ivanova Y, Dimitrova D, Maksimova V, Smilov K, Ackova DG, Miloseva L, Ruskovska T, Deligiannidou GE, Kontogiorgis CA, Pinto P.
 Nutrients. 2020 Sep 27;12(10):2960. doi: 10.3390/nu12102960.

The Mediterranean diet, plasma metabolome, and cardiovascular disease risk.

Li J, Guasch-Ferré M, Chung W, Ruiz-Canela M, Toledo E, Corella D, Bhupathiraju SN, Tobias DK, Tabung FK, Hu J, Zhao T, Turman C, Feng YA, Clish CB, Mucci L, Eliassen AH, Costenbader KH, Karlsson EW, Wolpin BM, Ascherio A, Rimm EB, Manson JE, Qi L, Martínez-González MA, Salas-Salvadó J, Hu FB, Liang L.
 Eur Heart J. 2020 Jul 21;41(28):2645-2656. doi: 10.1093/eurheartj/ehaa209.



14-item MEditerranean Diet Adherence Screener: MEDAS

Transferability of the Mediterranean Diet to Non-Mediterranean Countries. What Is and What Is Not the Mediterranean Diet

Miguel Ángel Martínez-González ^{1,2,3,4}, Maria Soledad Hershey ¹, Itziar Zazpe ^{1,2,4,5,*}
and Antonia Trichopoulou ^{6,7} 

Regardless of the operational score used, the traditional MedDiet is characterized by a high intake of vegetables, fruits, nuts, legumes, and mainly unrefined, minimally processed cereals; an abundant fat intake from virgin olive oil, through salads, traditionally cooked vegetables, and legumes; a moderate consumption of fish and shellfish, a low consumption of meat and meat products; and, the consumption of wine during meals. Fermented dairy products (cheese and yogurt) are allowed in moderate amounts.

The main sources of fat and alcohol are primarily virgin olive oil (VOO) and wine, respectively. They contain hydroxytyrosol and tyrosol, oleocanthal, resveratrol, and many other dietary bioactive phenolic compounds with substantial anti-inflammatory properties [46]. The anti-atherogenic properties of olive oil were supposedly attributed to its high oleic acid content [47]. However, in recent years, converging evidence indicates that bioactive polyphenols are only present in the extra virgin olive oil (EVOO) and may substantially contribute to these benefits [48].

■ Olive oil in modern MedDiet

- The Mediterranean diet is characterized by its relatively high total fat intake (from olive oil) that makes it palatable, but low in saturated fat and rich in nutrients and dietary fiber content.
- It is a diet that is rich in antioxidant compounds and bioactive elements with anti-inflammatory effects, and it has a low glycemic index.
- These health properties help to meet nutritional requirements, reach and maintain a healthy body weight, and reduce the risk for chronic disease.
- There is no healthy Mediterranean diet without olive oil

Transferability of the Mediterranean Diet to Non-Mediterranean Countries. What Is and What Is Not the Mediterranean Diet

Miguel Ángel Martínez-González^{1,2,3,4}, Maria Soledad Hershey¹, Itziar Zazpe^{1,2,4,5,*} and Antonia Trichopoulos^{6,7} 

WHAT IS NOT an “Indo-Mediterranean diet”, which is rich in whole grains, fruits, vegetables, walnuts, mustard, oil, and almonds is not either. Using other unsaturated fat cooking oils other than olive oil, such as flaxseed, peanut, corn, or sunflower oils, with similar or higher content in saturated fat than olive oil, do not pertain to the traditional MedDiet. Although alternative liquid oils (sunflower, canola, soya, or other seeds) that are rich in polyunsaturated lipids are better than lard or butter, they are uncharacteristic of the traditional MedDiet. The proper introduction of the traditional MedDiet in non-Mediterranean countries **requires the use of olive oil as the main culinary fat**. Some systematic reviews on the MedDiet misleadingly defined the MedDiet as any diet that meets at least two of nine traditional MedDiet characteristics (high consumption of olive oil, legumes, cereals, fruits and vegetables, moderate to high consumption of fish, low consumption of meat and meat products, and moderate consumption of dairy products, mostly as cheese and yogurt, and wine). This definition based on at least two of these characteristics completely lacks specificity, and therefore it may prove useless. Other misleading definitions of the MedDiet are based on macronutrient intake and may indirectly suggest that the MedDiet is defined solely by an unrestricted fat content. This is incorrect, however, a “low fat” MedDiet is not the traditional MedDiet either. The usual amount of fat in the MedDiet is 30–45%, but the important factor is not the amount, but the type of fat: olive oil, nuts, and fatty fish should be the main sources of fat, especially extra-virgin olive oil, which may represent 15% or more of the total caloric intake.

Source: Martínez JA, Toledo E, Martínez-González MA.

Nutrition Research Methodology: the scientific method and nutritional research.

In: Gibney MJ, et al.

Introduction to Human Nutrition.

The Nutrition Society Textbook series.

3rd ed. London: Blackwell Science, 2019.

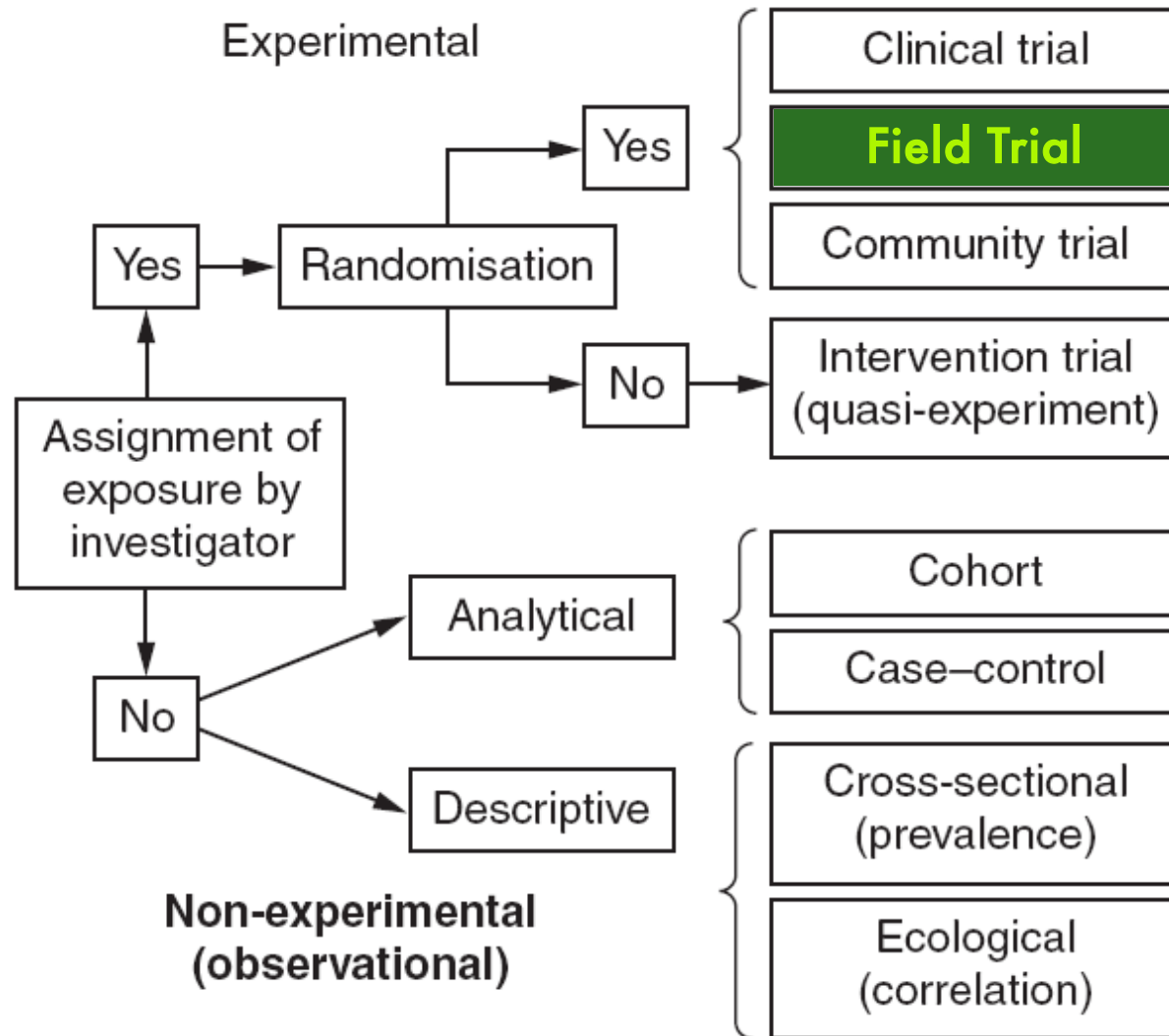
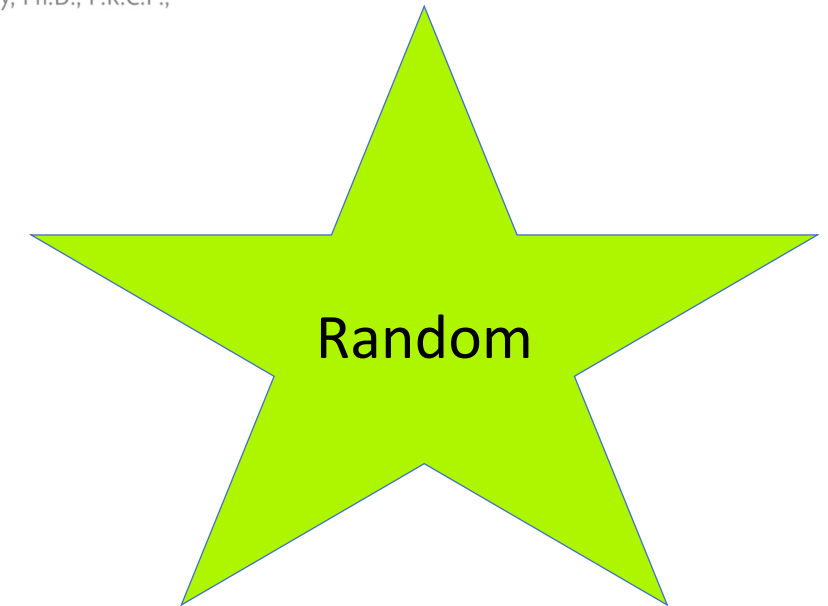


Figure 13.2 Classification of epidemiological designs.

SOUNDING BOARD

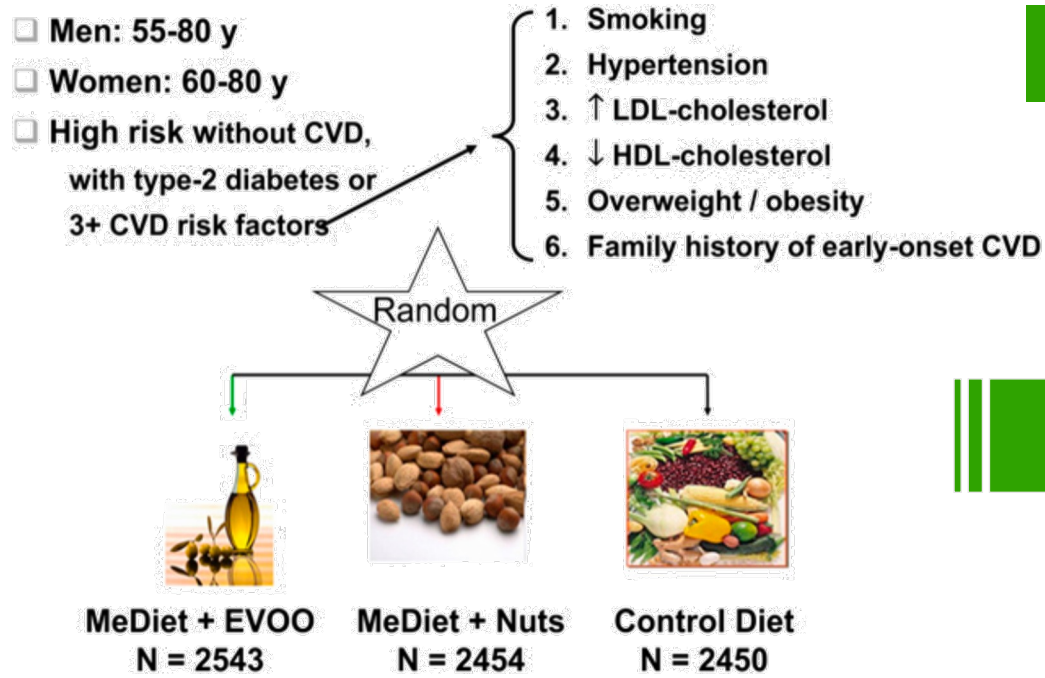
The Magic of Randomization versus the Myth
of Real-World EvidenceRory Collins, F.R.S., Louise Bowman, M.D., F.R.C.P., Martin Landray, Ph.D., F.R.C.P.,
and Richard Peto, F.R.S.

because of the potential biases inherent in observational studies, such studies cannot generally be trusted when — as is often the case — the effects of the treatment of interest are actually null or only moderate



randomized, controlled trials of adequate size are generally required to ensure that any moderate benefits or moderate harms of a treatment are assessed reliably enough to guide patient care

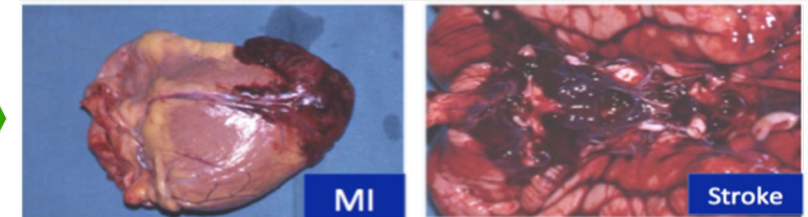
PREDIMED Prevención con Dieta Mediterránea



Field Trial

5 years

Myocardial Infarction– Heart Attack
 Cerebrovascular disease– Stroke
 Cardiovascular deaths

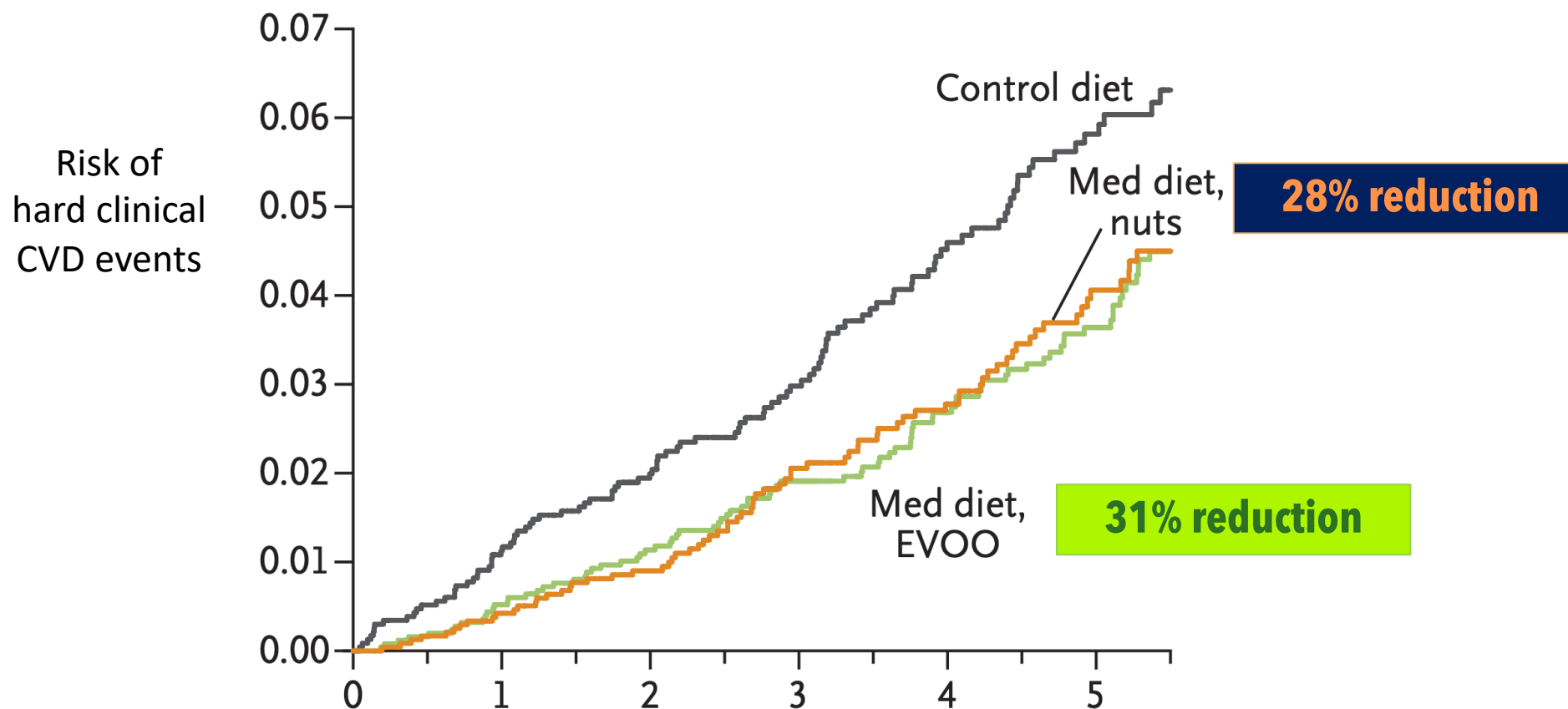


The Spanish PREDIMED
 randomized trial has provided
 the **best scientific evidence** on
 the benefits of the MedDiet &
 Olive oil in primary prevention

Predimed
 Prevención con Dieta Mediterránea

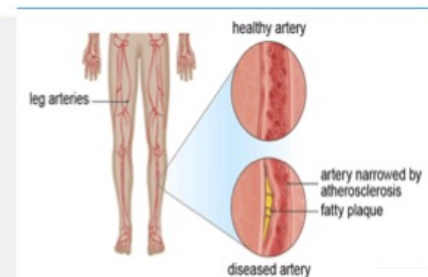
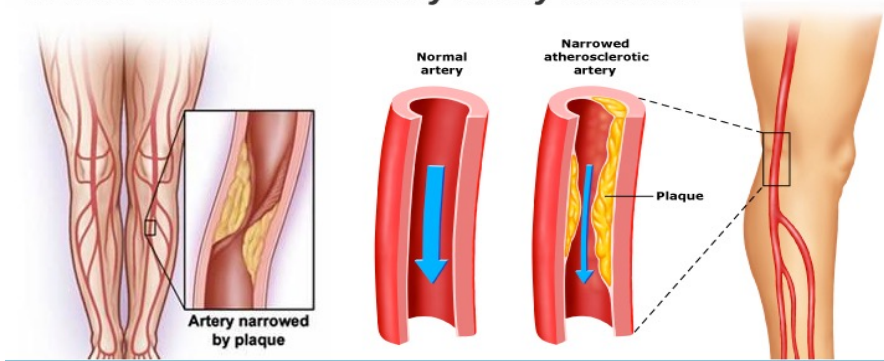
Med diet, EVOO: hazard ratio, 0.69 (95% CI, 0.53–0.91)

Med diet, nuts: hazard ratio, 0.72 (95% CI, 0.54–0.95)



Peripheral Artery Disease

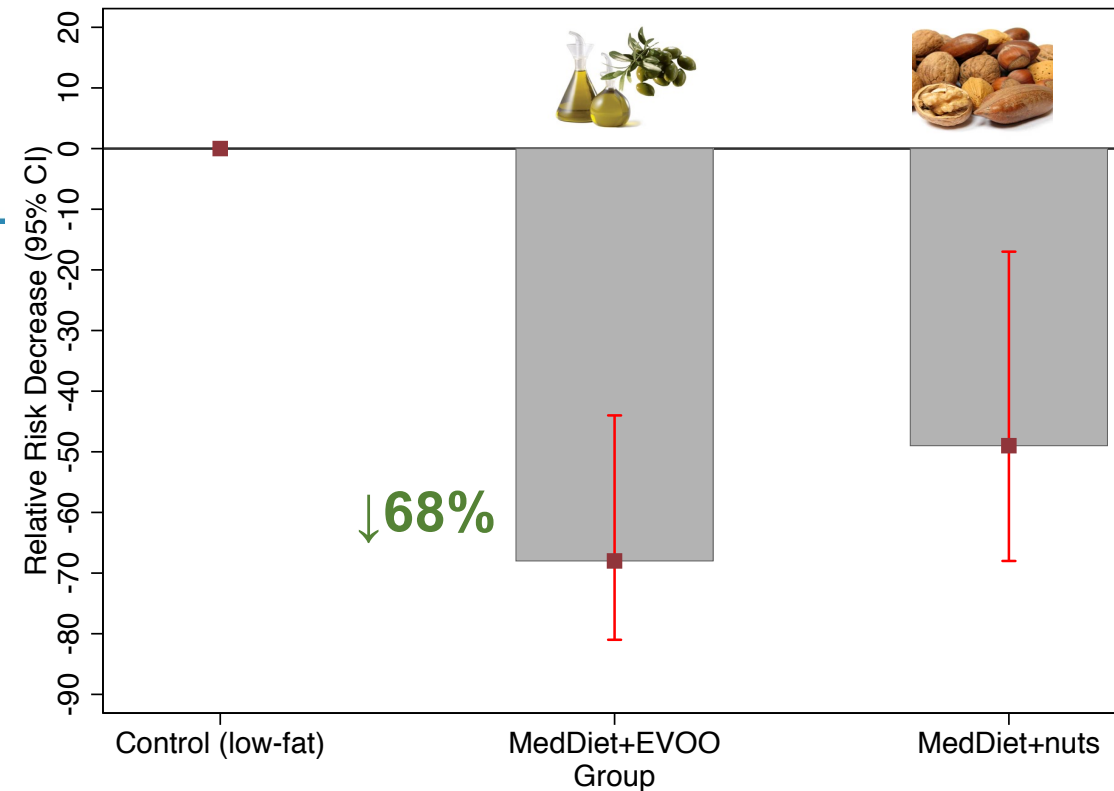
Peripheral Arterial Disease in the lower extremities is also linked to coronary artery disease.



How peripheral arterial disease affects the arteries



Predimed
 Prevención con Dieta Mediterránea



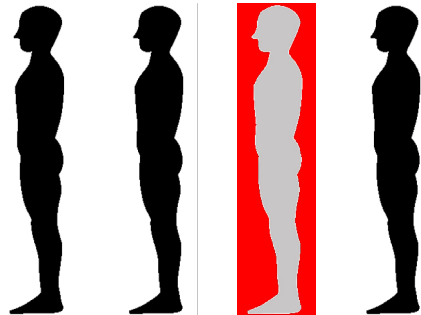
Main heart arrhythmia

Predimed
 Prevención con Dieta Mediterránea

Extravirgin Olive Oil Consumption Reduces Risk of Atrial Fibrillation

The PREDIMED (Prevención con Dieta Mediterránea) Trial

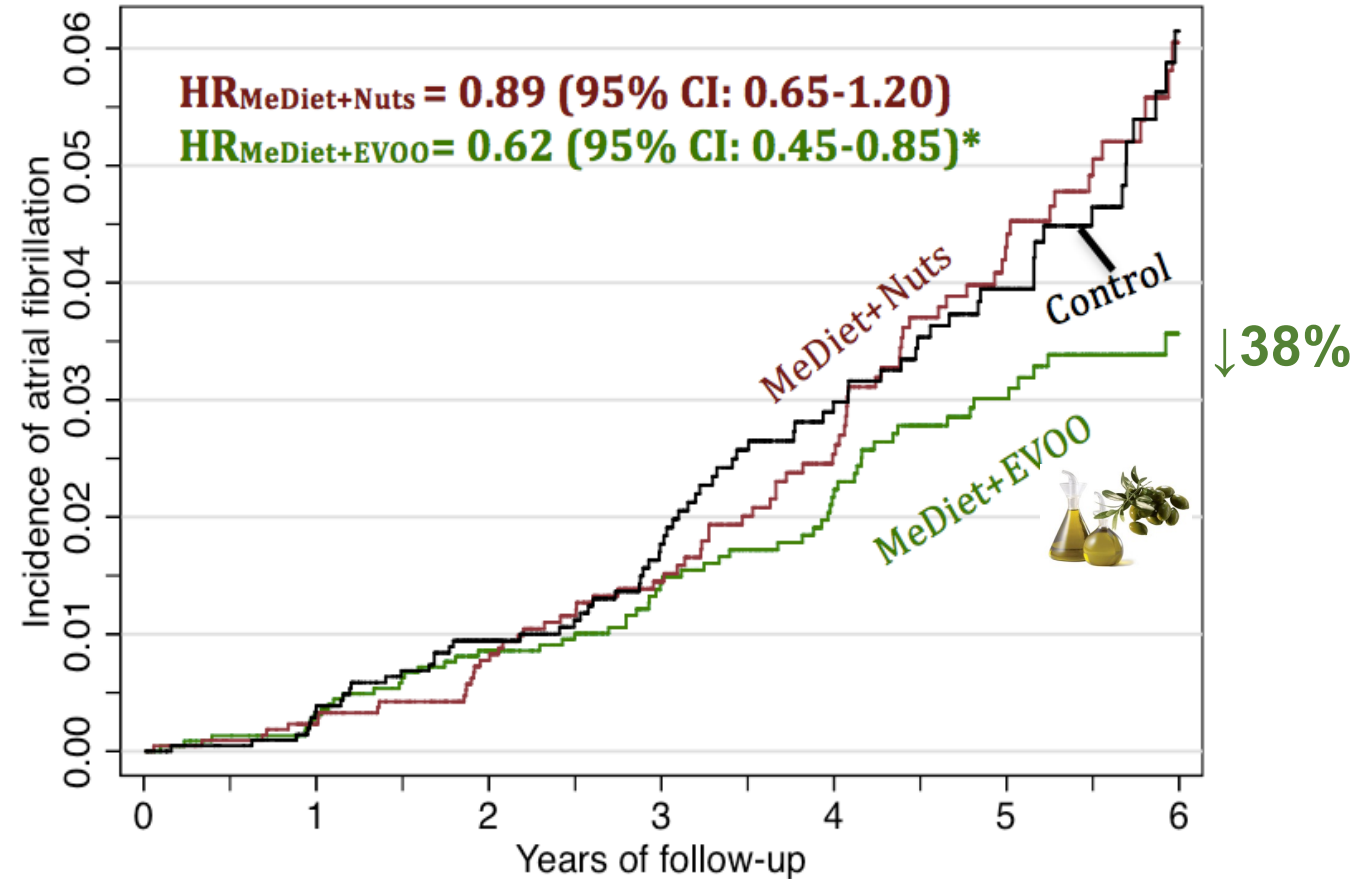
Miguel Á. Martínez-González, MD, PhD; Estefanía Toledo, MD, PhD;
 Fernando Arós, MD, PhD; Miquel Fiol, MD, PhD; Dolores Corella, DPharm, PhD;
 Jordi Salas-Salvadó, MD, PhD; Emilio Ros, MD, PhD; Maria I. Covas, DPharm, PhD;
 Joaquín Fernández-Crehuet, MD, PhD; José Lapetra, MD, PhD;
 Miguel A. Muñoz, MD, PhD; Monserrat Fitó, MD, PhD; Luis Serra-Majem, MD, PhD;
 Xavier Pintó, MD, PhD; Rosa M. Lamuela-Raventós, DPharm, PhD; Jose V. Sorlí, MD, PhD;
 Nancy Babio, BSc, PhD; Pilar Buil-Cosiales, MD, PhD; Valentina Ruiz-Gutierrez, PhD;
 Ramón Estruch, MD, PhD; Alvaro Alonso, MD, PhD; for the PREDIMED Investigators*



1 in 4 will develop

Atrial Fibrillation

after 40 years old



Number at risk

g = MeDiet+EVOO	2292	2234	2097	1798	1511	1144	496
g = MeDiet+Nuts	2210	2113	1899	1499	1244	903	387
g = Control	2203	2044	1837	1438	1152	851	358

Diabetes

Annals of Internal Medicine

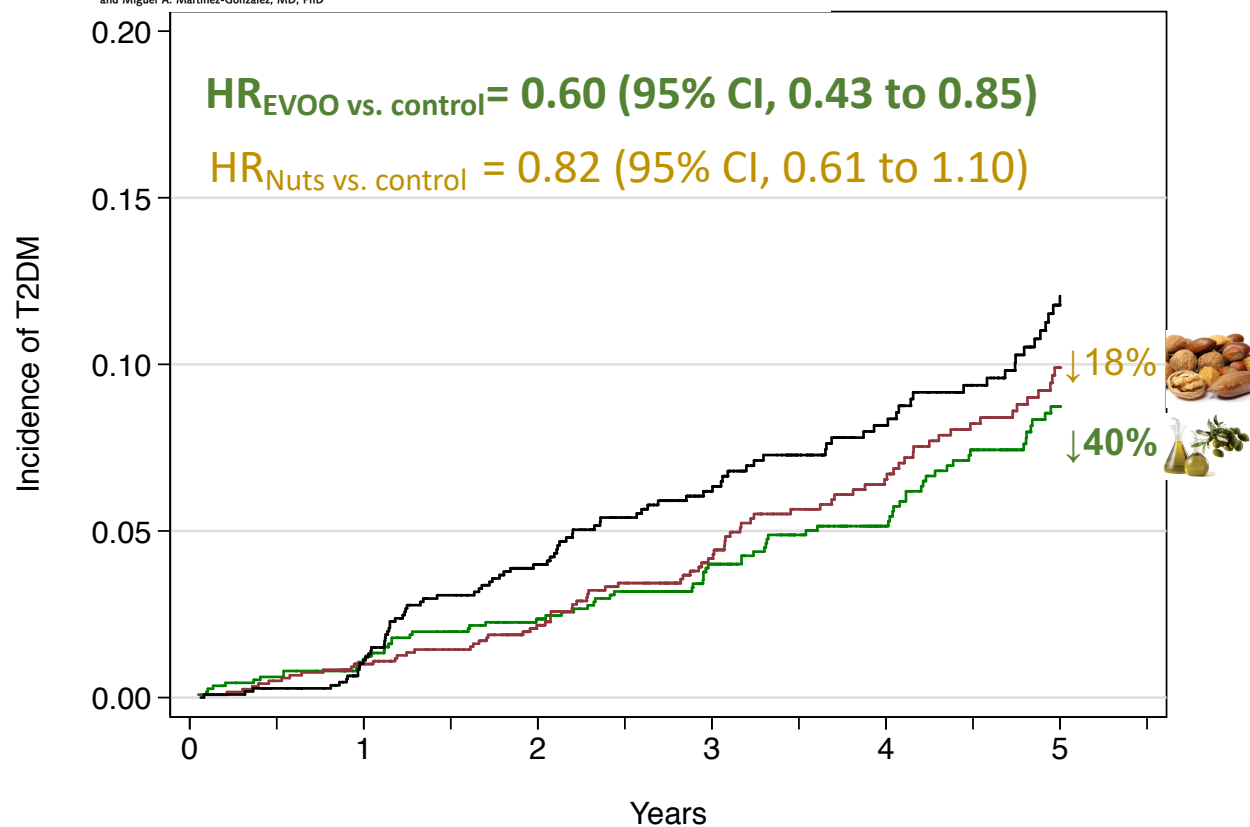
ORIGINAL RESEARCH

Prevention of Diabetes With Mediterranean Diets

A Subgroup Analysis of a Randomized Trial

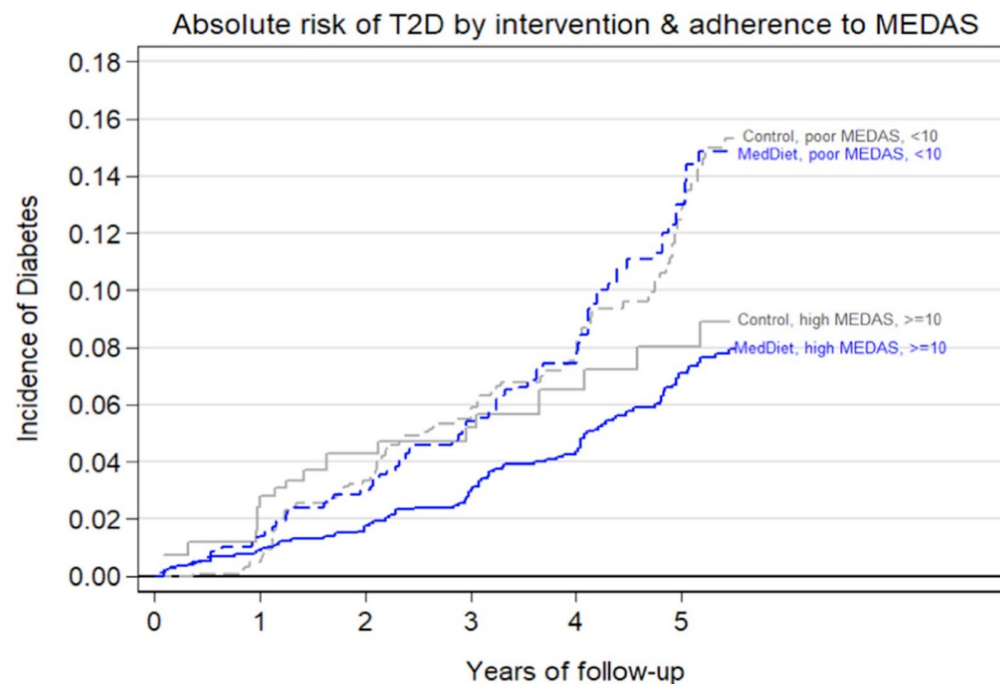
Jordi Salas-Salvadó, MD, PhD*; Mónica Bulló, PhD; Ramón Estruch, MD, PhD; Emilio Ros, MD, PhD; Maria-Isabel Covas, DPharm;
 Núria Ibarrola-Jurado, RD, PhD; Dolores Corella, DPharm, PhD; Fernando Arós, MD, PhD; Enrique Gómez-Gracia, MD, PhD;
 Valentina Ruiz-Gutiérrez, PhD; Dora Romaguera, MD, PhD; José Lapetra, MD, PhD; Rosa María Lamuela-Raventós, DPharm, PhD;
 Lluís Serra-Majem, MD, PhD; Xavier Pintó, MD, PhD; Josep Basora, MD, PhD; Miguel Angel Muñoz, MD, PhD; José V. Sorlí, MD, PhD;
 and Miguel A. Martínez-González, MD, PhD*

predimed
 Prevención con Dieta Mediterránea



Yearly attained adherence to Mediterranean diet and incidence of diabetes in a large randomized trial

Miguel A. Martínez-González^{1,2,3,4*}, Pedro Montero³, Miguel Ruiz-Canela^{1,2,3}, Estefanía Toledo^{1,2,3},
 Ramón Estruch^{1,5}, Enrique Gómez-Gracia⁶, Jun Li^{4,8}, Emilio Ros^{1,9}, Fernando Arós^{1,10}, Alvaro Hernández^{1,11,12,13},
 Dolores Corella^{1,14}, Miquel Fiol^{1,15}, José Lapetra^{1,16}, Lluís Serra-Majem^{1,17}, Xavier Pintó^{1,18}, Montse Cofán⁹,
 José V. Sorlí^{1,14}, Nancy Babio^{1,19,7}, Yolanda F. Márquez-Sandoval²⁰, Olga Castañer^{11,21} and Jordi Salas-Salvadó^{1,19}



Breast Cancer

Predimed
 Prevención con Dieta Mediterránea



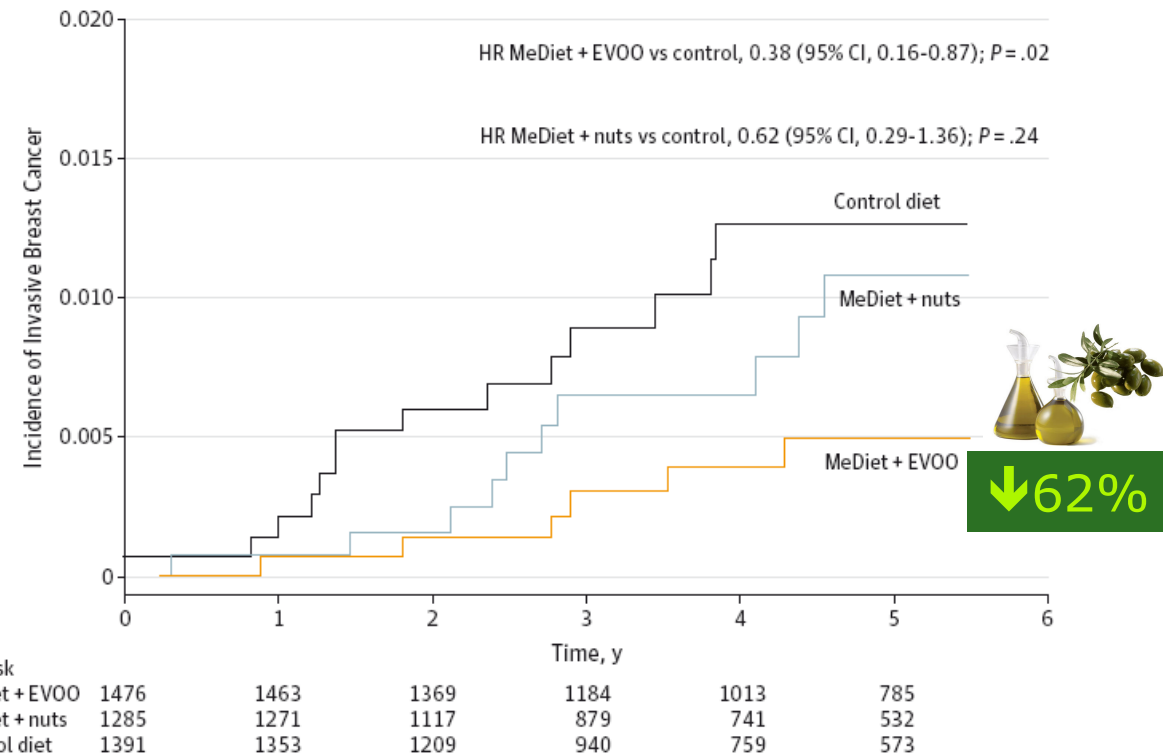
Original Investigation

Mediterranean Diet and Invasive Breast Cancer Risk Among Women at High Cardiovascular Risk in the PREDIMED Trial A Randomized Clinical Trial

Estefanía Toledo, MD, MPH, PhD; Jordi Salas-Salvadó, MD, PhD; Carolina Donat-Vargas, PharmD;
 Pilar Buil-Cosiales, MD, PhD; Ramón Estruch, MD, PhD; Emilio Ros, MD, PhD; Dolores Corella, DPharm, PhD;
 Montserrat Fitó, PhD; Frank B. Hu, MD, PhD; Fernando Arós, MD, PhD; Enrique Gómez-Gracia, MD, PhD;
 Dora Romaguera, MSc, PhD; Manuel Ortega-Calvo, MD; Lluís Serra-Majem, MD, PhD; Xavier Pintó, MD, PhD;
 Helmut Schröder, PhD; Josep Basora, MD, PhD; José Vicente Sorlí, MD, PhD; Mònica Bulló, BSc, PhD;
 Merce Serra-Mir, RD; Miguel A. Martínez-González, MD



Women assigned to the
 intervention with
MedDiet+Extra virgin olive oil had
 a 62% lower risk of developing
 breast cancer



Dementia

Original Investigation

Mediterranean Diet and Age-Related Cognitive Decline A Randomized Clinical Trial

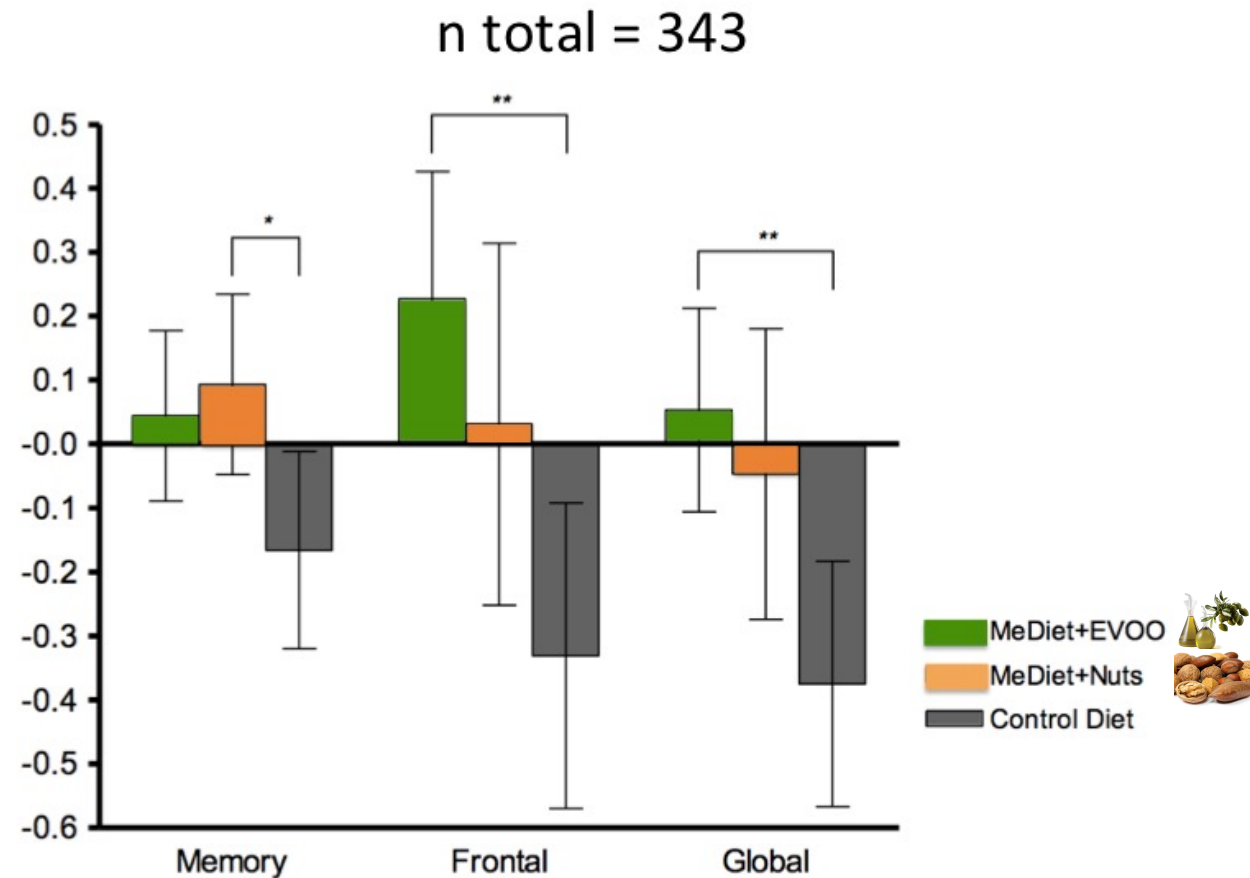
Cinta Valls-Pedret, MSc; Aleix Sala-Vila, DPharm, PhD; Mercè Serra-Mir, RD; Dolores Corella, DPharm, PhD; Rafael de la Torre, DPharm, PhD;
 Miguel Ángel Martínez-González, MD, PhD; Elena H. Martínez-Lapiscina, MD, PhD; Montserrat Fitó, MD, PhD; Ana Pérez-Heras, RD;
 Jordi Salas-Salvadó, MD, PhD; Ramon Estruch, MD, PhD; Emilio Ros, MD, PhD May 11, 2015 11:00 am ET

Predimed
 Prevención con Dieta Mediterránea

JAMA Internal Medicine
 Formerly Archives of Internal Medicine

follow-up: 4.1 y

Changes of
 mean
cognitive
 z scores
 (final minus
 baseline)



Olive Oil Consumption and Cardiovascular Risk in U.S. Adults



Marta Guasch-Ferré, PhD,^{a,b} Gang Liu, PhD,^c Yanping Li, PhD,^a Laura Sampson, RD,^a JoAnn E. Manson, MD, DrPH,^{b,d,e} Jordi Salas-Salvadó, MD, PhD,^{f,g} Miguel A. Martínez-González, MD, PhD,^{a,g,h} Meir J. Stampfer, MD, PhD,^{b,d} Walter C. Willett, MD, DrPH,^{a,b,d} Qi Sun, MD, PhD,^{a,b} Frank B. Hu, MD, PhD^{a,b,d}

In 2 large prospective cohorts followed for 24 years, we found inverse associations between olive oil consumption and the incidence of cardiovascular events after adjusting for cardiovascular risk factors

As compared with nonconsumers, those with higher consumption of olive oil had

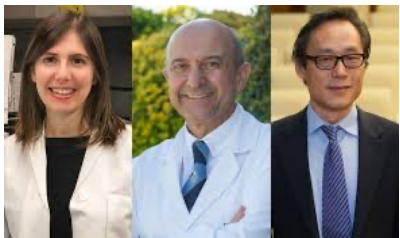
- 14% lower risk of CVD
- 18% lower risk of CHD

	Nurses' Health Study	Health Professionals Follow-Up Study	Pooled	Pooled Hazard Ratios (95% CI)
Cardiovascular disease				
Olive oil for margarine				0.94 (0.91-0.97)
Olive oil for butter				0.95 (0.91-1.00)
Olive oil for mayonnaise				0.93 (0.89-0.98)
Olive oil for other vegetable oils				0.98 (0.92-1.04)
Olive oil for dairy fat				0.95 (0.92-0.98)
Olive oil for all other fats				0.94 (0.91-0.97)

Hazard ratios (HRs) for CVD associated with substitution of 5 g/day of olive oil for equivalent amounts of other fats

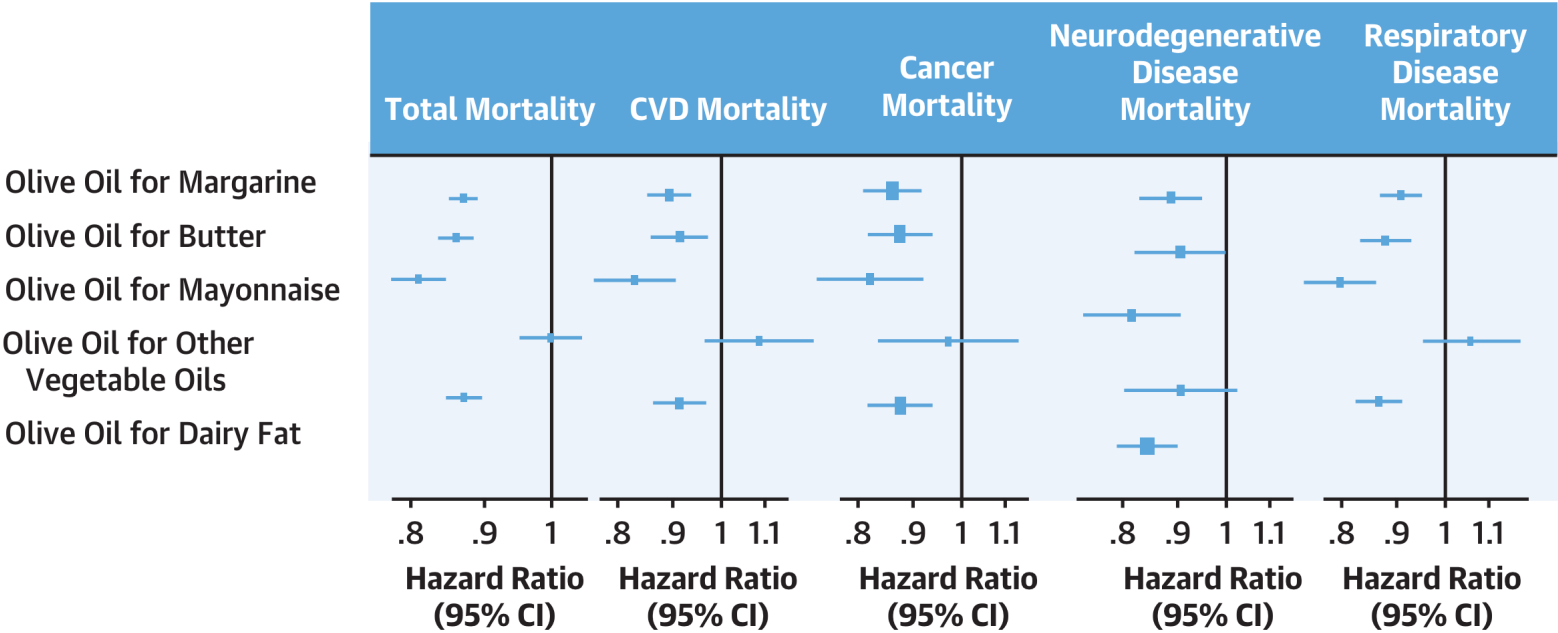
Consumption of Olive Oil and Risk of Total and Cause-Specific Mortality Among U.S. Adults

Marta Guasch-Ferré, PhD,^{a,b} Yanping Li, PhD,^a Walter C. Willett, MD, DrPH,^{a,b,c} Qi Sun, MD, ScD,^{a,b,c,d}
 Laura Sampson, RD,^a Jordi Salas-Salvadó, MD,^{e,f} Miguel A. Martínez-González, MD,^{a,e,g}
 Meir J. Stampfer, MD, DrPH,^{a,b,c} Frank B. Hu, MD, PhD^{a,b,c}



- 60,582 women + 31,801 men
- 28 years of follow-up
- 36,856 deaths
- repeated measurements each 4-y

- As compared with nonconsumers, those with higher consumption of **olive oil** had
- 19% lower risk of all-cause & CVD death
 - 17% lower risk of cancer mortality
 - 29% lower risk of neurodegenerative mortality
 - 18% lower risk of respiratory mortality



Hazard ratios (HRs) associated with substitution of 10 g/day of olive oil for equivalent amounts of other fats

Original article

Olive oil consumption is associated with a lower risk of cardiovascular disease and stroke



Carolina Donat-Vargas ^{a, b, c, d, *}, Helena Sandoval-Insausti ^{b, c, e}, José L. Peñalvo ^f, Maria Concepción Moreno Iribas ^{i, l}, Pilar Amiano ^{c, j, k}, Maira Bes-Rastrollo ^{g, h, l}, Esther Molina-Montes ^{c, m, n, o}, Belén Moreno-Franco ^{p, q}, Antonio Agudo ^r, Cristina Lasheras Mayo ^s, Martín Laclaustra ^{p, q}, Carmen De La Fuente Arrillaga ^{g, h, l}, Maria Dolores Chirlaque Lopez ^{c, t}, Maria-José Sánchez ^{c, o, u, v}, Miguel Angel Martínez-Gonzalez ^{e, g, h, l}, Pilar Guallar-Castillón ^{a, b, c}



These analyses carried out in **three Spanish studies** add evidence to the suggested inverse association of olive oil consumption with CVD. Overall inverse associations are **consistently observed when examining total olive oil consumption in all cardiovascular end-points in the three cohorts**. Results from the EPIC study suggest a maximum benefit between 20 and 30 g/day, while consumptions above 30 g/day may not provide further advantage. The protective effect could be greater for virgin olive oil while also operating from early stages of the disease.

We believe that the associations we are reporting can be considered as properly causal

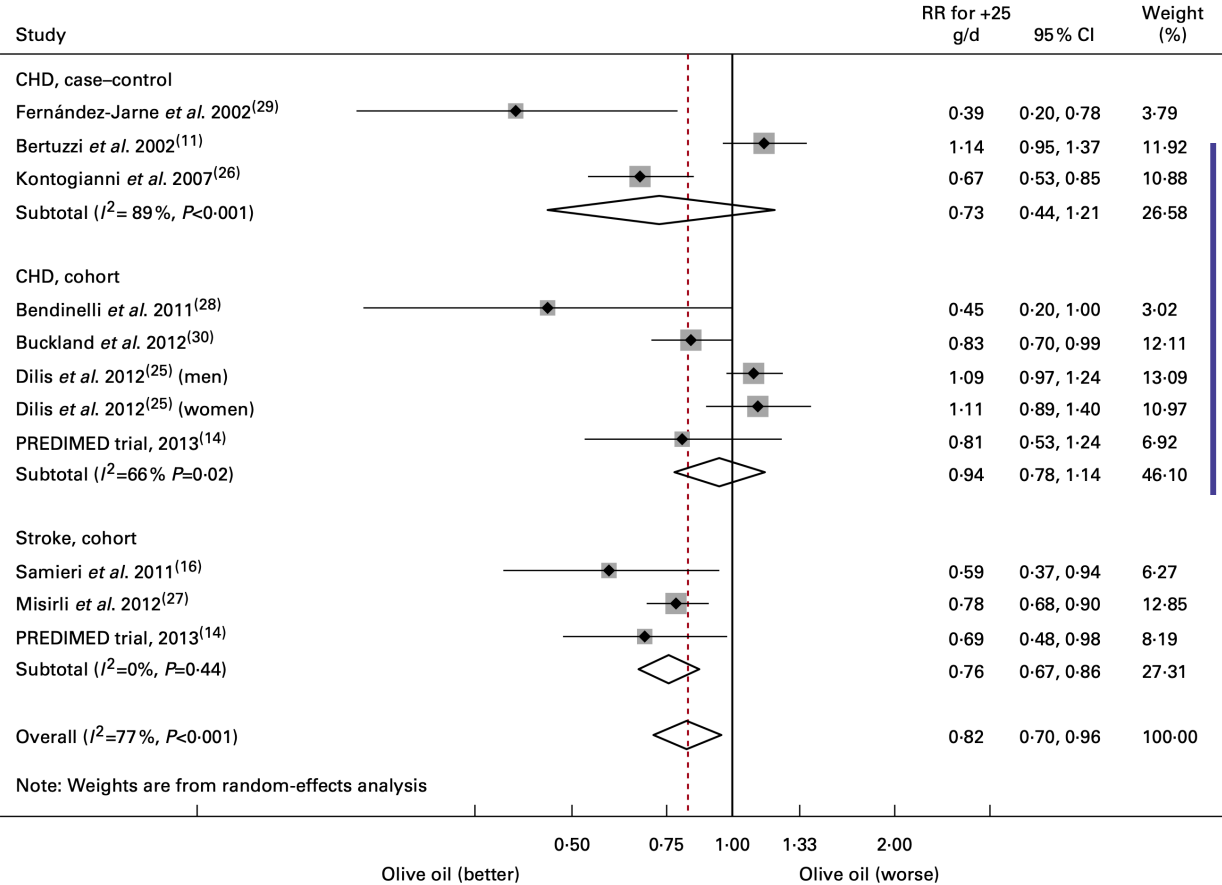
Three cohorts:

- AWHs (2318 men)
- SUN Project (18,266 men and women)
- EPIC-Spain (39,393 men and women)

Olive oil consumption and risk of CHD and/or stroke: a meta-analysis of case–control, cohort and intervention studies

Miguel A. Martínez-González^{1,2}, Ligia J. Dominguez^{3*} and Miguel Delgado-Rodríguez^{4,5}

Olive oil and cardiovascular events



In conclusion, the overall evidence supports a protection of olive oil consumption against hard cardiovascular end-points, and specifically against stroke. However, the evidence is scarce and no significant protection can be afforded specifically against CHD; in addition, publication bias can affect these results. Further studies with larger sample sizes and a better distinction between virgin *v.* ordinary olive oil with respect to the risk of CHD are needed.

Meta-analyses

Effect of olive oil consumption on cardiovascular disease, cancer, type 2 diabetes, and all-cause mortality: A systematic review and meta-analysis

Miguel A. Martínez-González ^{a,*}, Carmen Sayón-Orea ^a, Vanessa Bullón-Vela ^a,
 Maira Bes-Rastrollo ^a, Fernando Rodríguez-Artalejo ^b, María José Yusta-Boyo ^c,
 Marta García-Solano ^c

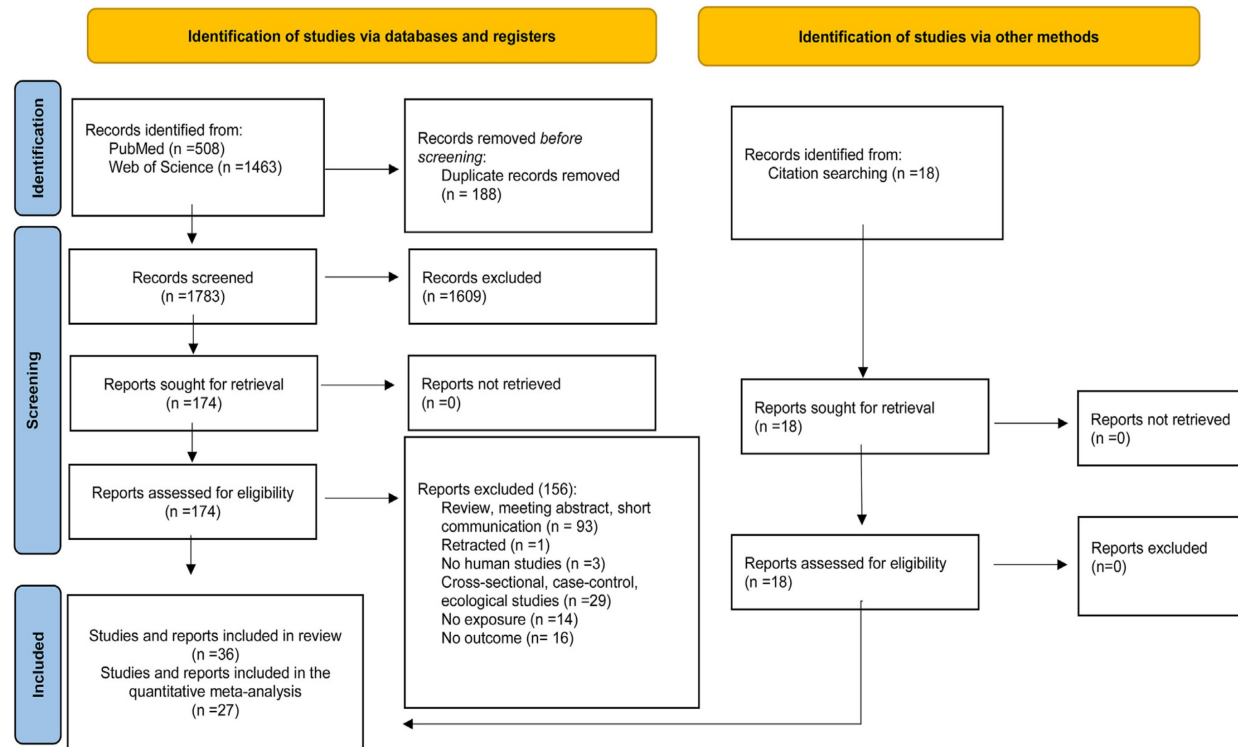


Fig. 1. Flow chart for selection of articles relating olive oil with cardiovascular disease, cancer, type 2 diabetes or all-cause mortality.

In this outcome-wide systematic review and meta-analysis of the association between olive oil and hard clinical events of chronic disease, we found evidence for a protective association against CVD, T2D, and all-cause mortality, but not for cancer. In line with our results, a previous meta-analysis reported that olive oil intake was associated with reduced risk of all-cause mortality and combined CVD events when comparing the highest versus the lowest tertile

- **16%** reduced risk of CVD (6 to 24%), for every additional olive oil consumption of 25 g/d
- **22%** lower relative risk of diabetes (13% to 31%, per 25 g/d)
- **11%** relative reduction in all-cause death; (7% to 15%, per 25 g/d).

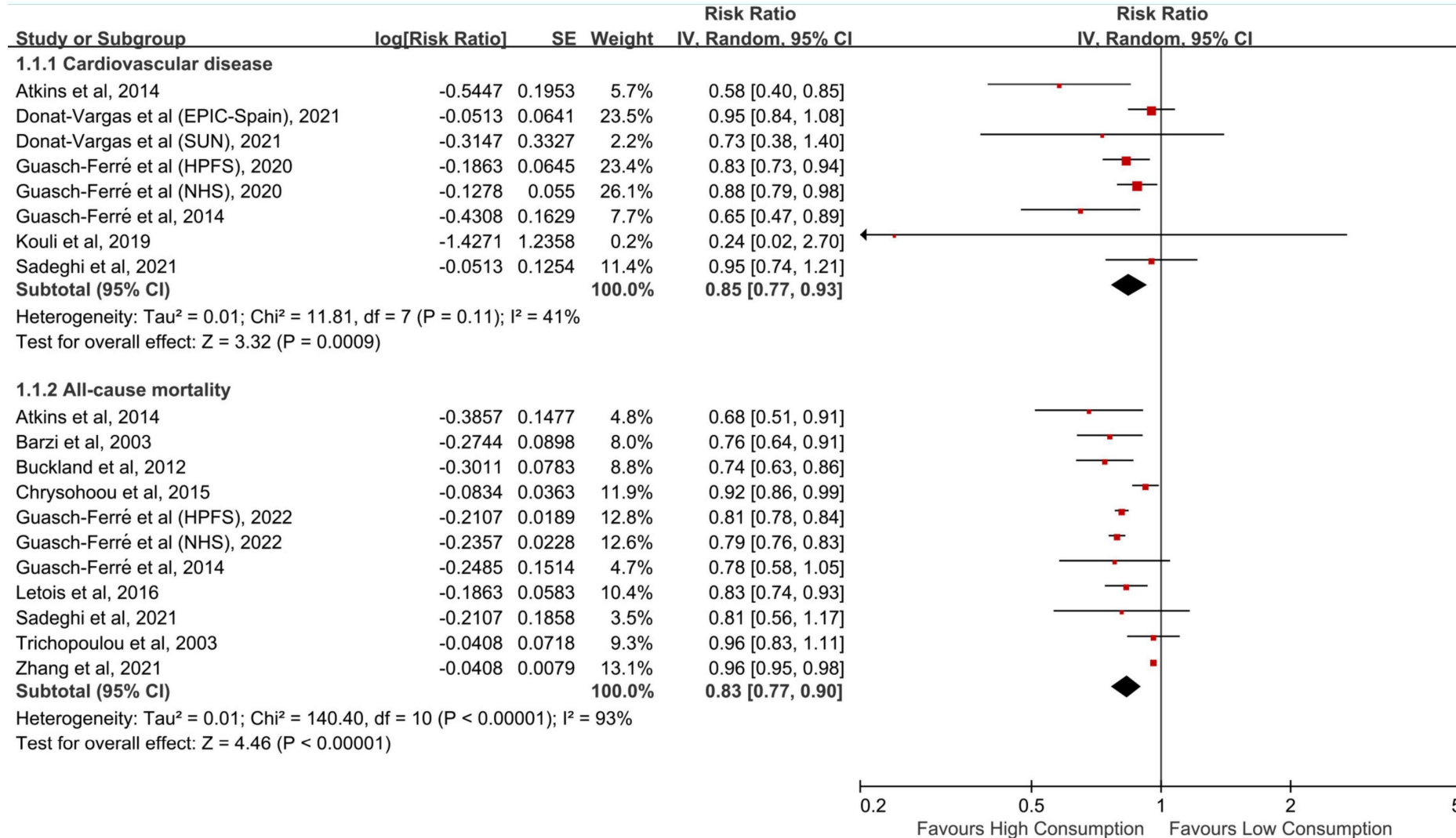
Olive oil consumption and risk of cardiovascular disease and all-cause mortality: A meta-analysis of prospective cohort studies

Meng Xia, Yi Zhong, Yongquan Peng and Cheng Qian*

Results: This meta-analysis included 13 studies comprising a total of 13 prospective cohorts. Compared with lower consumption, higher consumption of olive oil conferred a significantly reduced risk in CVD (RR: 0.85, 95% CI: 0.77-0.93, $p < 0.001$) and all-cause mortality (RR: 0.83, 95% CI: 0.77-0.90, $p < 0.001$). This beneficial effect was not modified by the potential confounders

study-level RRs for the highest vs. lowest consumption of olive oil were combined using random-effect models.

Olive oil consumption and risk of cardiovascular disease and all-cause mortality: A meta-analysis of prospective cohort studies
 Meng Xia, Yi Zhong, Yongquan Peng and Cheng Qian*



■ Olive oil in modern MedDiet

- Consistency
- Strong inverse association
- Temporal sequence
- Dose-response
- Experimental evidence
- Coherence
- Specificity
- Control of bias
- [Biological plausibility]

**Such accrual of
rigorous evidence
is not currently
available
for any other food**



*Taste it, enjoy it.
it's olive oil.*

Thank you!

mamartinez@unav.es
martinez@hsph.harvard.edu