Adherence to the Western, Prudent, and Mediterranean dietary patterns and chronic lymphocytic leukemia in the MCC-Spain study

Marta Solans,[1,2,3*] Adela Castelló,[1,4,5*] Yolanda Benavente,[1,6] Rafael Marcos-Gragera,[2,3] Pilar Amiano,[1,7] Esther Gracia-Lavedan,[1,8,9] Laura Costas,[6] Claudia Robles,[10] Eva Gonzalez-Barca,[11] Esmeralda de la Banda,[12] Esther Alonso,[12] Marta Aymerich,[13] Elias Campo,[13] Trinidad Dierssen-Sotos,[1,14] Guillermo Fernández-Tardón,[1,15] Rocio Olmedo-Requena,[1,16,17] Eva Gimeno,[18] Gemma Castaño-Vinyals,[1,8,9,19,] Nuria Aragonés,[1,20] Manolis Kogevinas,[1,8,9,19] Silvia de Sanjose,[1,6,21] Marina Pollán[1,4] and Delphine Casabonne[1,6**]**

[1]Centro de Investigación Biomédica en Red: Epidemiología y Salud Pública (CIBERESP), Madrid, Spain; [2]Research Group on Statistics, Econometrics and Health (GRECS), University of Girona, Spain; [3]Epidemiology Unit and Girona Cancer Registry, Catalan Institute of Oncology, Girona, Spain; [4]Cancer Epidemiology Unit, National Centre for Epidemiology, Carlos III Institute of Health, Madrid, Spain; [5]Faculty of Medicine, University of Alcalá, Alcalá de Henares, Madrid, Spain; [6]Unit of Molecular Epidemiology and Genetic in Infections and Cancer (UNIC-Molecular), Cancer Epidemiology Research Programme (IDIBELL), Catalan Institute of Oncology, L' Hospitalet De Llobregat, Spain; [7]Public Health Division of Gipuzkoa, BioDonostia Research Institute, San Sebastian, Spain; [8]ISGlobal, Barcelona, Spain; [9]Universitat Pompeu Fabra (UPF), Barcelona, Spain; [10]Unit of Information and Interventions in Infections and Cancer (UNIC-I&I), Cancer Epidemiology Research Programme, (IDIBELL), Catalan Institute of Oncology, L' Hospitalet De Llobregat, Spain; [11]Hematology, Bellvitge Biomedical Research Institute (IDIBELL), Catalan Institute of Oncology, L'Hospitalet de Llobregat, Spain; [12]Hematology Laboratory, Department of Pathology, Hospital Universitari de Bellvitge, L'Hospitalet de Llobregat, Spain; [13]Hospital Clinic de Barcelona, University of Barcelona, CIBERONC, Barcelona Spain; [14]University of Cantabria - Marqués de Valdecilla Research Institute (IDIVAL), Santander, Spain; [15]University Institute of Oncology (IUOPA), University of Oviedo, Spain; [16]Department of Preventive Medicine and Public Health, University of Granada, Spain; [17]Instituto de Investigación Biosanitaria de Granada, Hospitales Universitarios de Granada, Spain; [18]Hematology Department, Hospital del Mar, Barcelona, Spain; [19]Hospital del Mar Medical Research Institute (IMIM), Barcelona, Spain; [20]Epidemiology Section, Public Health Division, Department of Health of Madrid, Spain and [21]PATH, Reproductive Health, Seattle, WA, USA

**MS and AC contributed equally to this work. **MP and DC contributed equally to this work.*

 doi:10.3324/haematol.2018.192526

Received: March 6, 2018.

Accepted: June 25, 2018.

Pre-published: June 28, 2018.

Correspondence: dcasabonne@iconcologia.net

Supplementary material

Table S1. Composition of food groups on the food frequency questionnaire of the MCC-Spain study and component loading for each pattern identified in the EpiGEICAM study [30].

Food group	Food	L_W[1]	L_P[1]	L_M[1]
High-fat dairy	Whole-fat milk, condensed milk, whole-fat yogurt, semi-cured, cured, or creamy cheese, blue cheese, custard, milk shake, ice-cream, double cream.	0.60	−0.11	0.20
Low-fat dairy	Semi-skimmed and skimmed milk, soy milk, skimmed yogurt, curd, cottage or fresh white cheese.	−0.49	0.60	−0.01
Eggs	Eggs.	0.19	0.08	0.16
White meat	Chicken, rabbit and duck.	0.08	0.17	0.18
Red meat	Pork, beef, lamb, liver (beef, pork or chicken), entrails, hamburgers (pork or beef) and meatballs (pork or beef).	0.27	0.09	0.22
Processed meat	Sausages, serrano ham and other cold meat, bacon, pâté, foie-gras.	0.36	0.10	0.26
White fish	Fresh or frozen white fish (hake, sea bass, sea bream), ½·salted fish and ½·smoked fish.	0.01	0.24	0.34
Oily fish	Fresh or frozen blue fish (tuna, swordfish, sardines, anchovies, salmon), canned fish, ½·salted fish and ½·smoked fish.	0.05	0.24	0.44
Seafood/shellfish	Clams, mussels, oysters, squid, cuttlefish, octopus, prawn, crab, shrimp and similar products.	0.17	0.27	0.35
Leafy vegetables	Spinach, chard, lettuce and other leafy vegetables.	−0.11	0.34	0.40
Fruiting vegetables	Tomato, eggplant, zucchini, cucumber, pepper, artichoke and avocado.	0.00	0.36	0.45
Root vegetables	Carrot, pumpkin and radish.	0.05	0.35	0.44
Other vegetables	Cooked cabbage, cauliflower or broccoli, onion, green beans, asparagus, mushrooms, corn, garlic, gazpacho, vegetable soup and other vegetables.	−0.04	0.40	0.42
Legumes	Peas, lentils, chickpeas, beans and broad beans.	0.21	0.15	0.34
Potatoes	Roasted or boiled potatoes and sweet potatoes.	0.17	0.25	0.40
Fruits	Orange, grapefruit, mandarin, banana, apple, pear, grapes, kiwi, strawberries, cherries, peach, figs, melon or watermelon, prunes, mango and papaya and other fresh or dried fruits.	−0.07	0.31	0.31
Nuts	Almonds, peanuts, pine nuts, hazelnut	0.18	0.22	0.29
Refined grains	White-flour bread, rice, pasta	0.37	0.15	0.23

Whole grains	Whole-grain bread and breakfast cereals	−0.43	0.47	−0.06
Olives and vegetable oil	Olives, added olive oil to salads, bread and dishes, other vegetable oils (sunflower, corn, and soybean).	0.12	0.19	0.34
Other edible fats	Margarine, butter and lard.	0.22	0.02	0.11
Sweets	Chocolate and other sweets, cocoa powder, plain cookies, chocolate cookies, pastries (croissant, donut, cake, pie or similar)	0.35	0.18	0.05
Sugary	Jam, honey, sugar and fruit in sugar syrup.	0.24	0.05	0.00
Juices	Tomato juice, freshly squeezed orange juice, juice (other than freshly squeezed)	0.25	0.67	−0.39
Caloric drinks	Sugar-sweetened soft drinks and nut milk.	0.74	0.21	−0.25
Convenience food and sauces	Croquette, fish sticks, dumplings, kebab, fried potatoes, crisps, pizza, instant soup, mayonnaise, tomato sauce, hot sauce, ketchup and other sauces.	0.47	0.12	0.24

[1]Component loadings for the W: Western; P: Prudent; M: Mediterranean dietary patterns.

Table S2: Association between adherence to dietary patterns and risk of chronic lymphocytic leukemia by time from diagnosis to interview, in the MCC-Spain study.

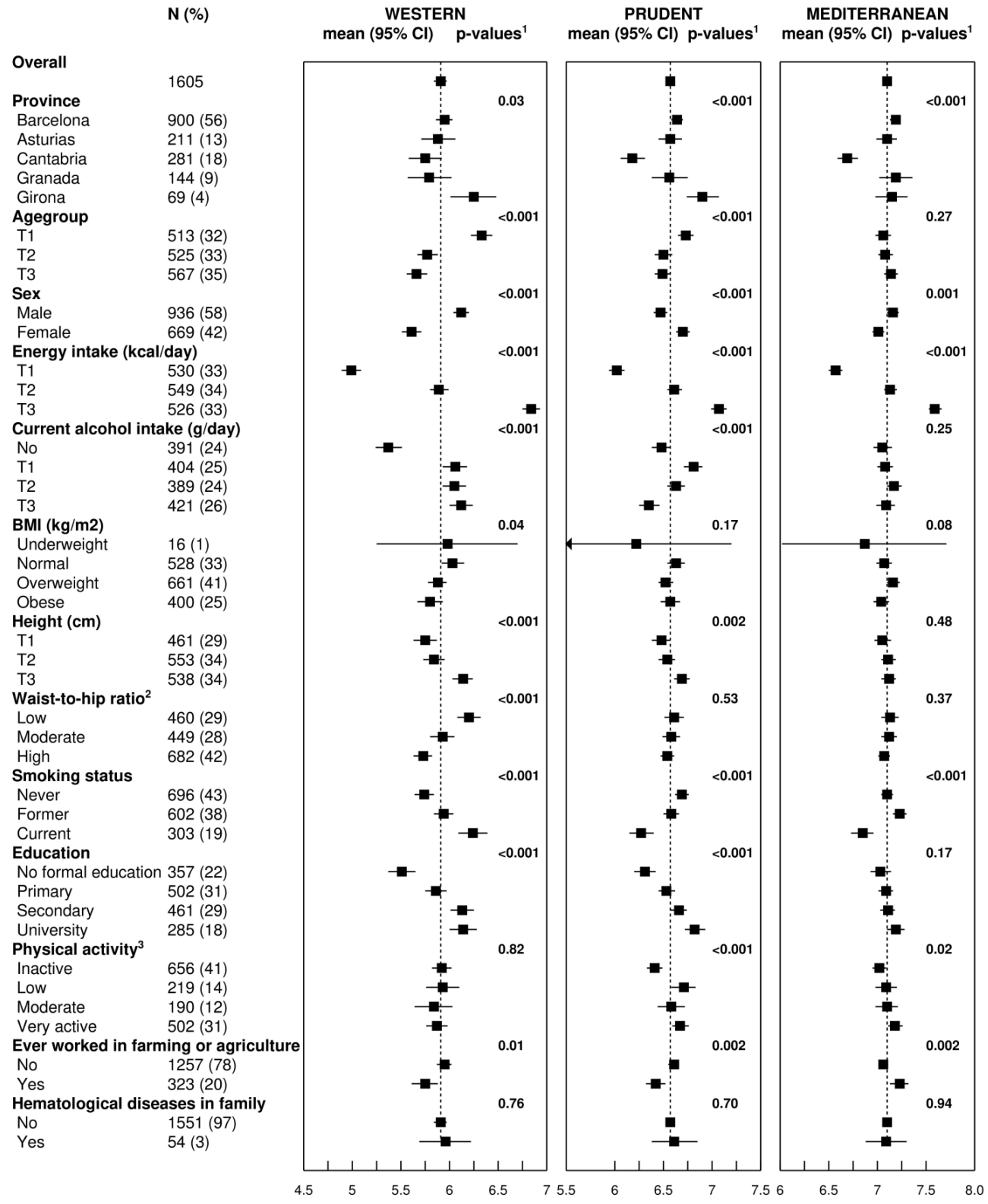
		<1 year from diagnosis		≥ 1 year from diagnosis		
	Controls N(%) (n=1.543)	**Cases N(%) (n=98)**	**OR[1] (95% CI)**	**Cases N(%) (n=271)**	**OR[1] (95% CI)**	**p-het[2]**
Western						
Q1	402 (25)	23 (23)	1	54 (20)	1	
Q2	401 (25)	20 (20)	0.89 (0.48;1.66)	70 (26)	1.30 (0.88;1.93)	
Q3	401 (25)	18 (18)	0.78 (0.41;1.49)	70 (26)	1.36 (0.92;2.02)	
Q4	401 (25)	37 (38)	1.69 (0.96;3.00)	77 (28)	1.56 (1.05;2.31)	
p-trend			0.073		0.03	
1-SD increase			1.16 (0.93;1.45)		1.18 (1.03;1.36)	0.90
Prudent						
Q1	402 (25)	26 (27)	1	54 (20)	1	
Q2	401 (25)	26 (27)	0.90 (0.51;1.60)	66 (24)	1.13 (0.76;1.67)	
Q3	401 (25)	20 (20)	0.67 (0.37;1.24)	69 (25)	1.20 (0.81;1.77)	
Q4	401 (25)	26 (27)	0.84 (0.47;1.49)	82 (30)	1.42 (0.96;2.08)	
p-trend			0.402		0.07	
1-SD increase			0.94 (0.76;1.16)		1.14 (0.99;1.32)	0.11
Mediterranean						
Q1	402 (25)	23 (23)	1	59 (22)	1	
Q2	401 (25)	24 (24)	0.92 (0.51;1.67)	64 (24)	0.99 (0.67;1.46)	
Q3	401 (25)	32 (33)	1.13 (0.65;1.99)	73 (27)	1.10 (0.75;1.61)	
Q4	401 (25)	19 (19)	0.65 (0.35;1.22)	75 (28)	1.13 (0.77;1.65)	
p-trend			0.313		0.43	
1-SD increase			0.94 (0.76;1.15)		1.05 (0.92;1.21)	0.33

OR, odds ratio; 95% CI, 95% confidence interval; Q, quartile; SD, standard deviation.
[1]Multinomial-logistic regression models adjusted for age, sex, level of education, energy intake (kcal/day), body mass index (kg/m^2) with province of residence as a random effect.
[2]P-value for the heterogeneity of effects
In bold: P-trend< 0.05

Table S3: Association between adherence to dietary patterns and risk of chronic lymphocytic leukemia according to treatment prior to interview, in the MCC-Spain study.

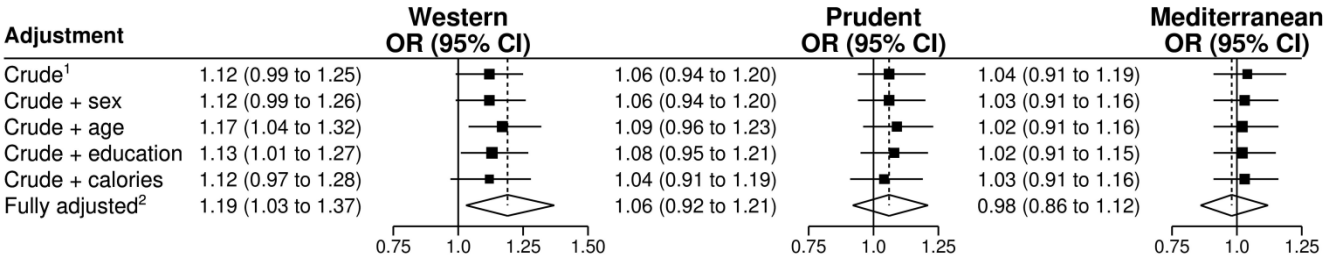
		Cases not treated before the interview		Cases treated before the interview		
	Controls N(%) (n=1,605)	**Cases N(%) (n=288)**	**OR[1] (95% CI)**	**Cases N(%) (n=79)**	**OR[1] (95% CI)**	**p-het[2]**
Western						
Q1	402 (25)	66 (23)	1	11 (14)	1	
Q2	401 (25)	71 (25)	1.11 (0.76;1.62)	18 (23)	1.54 (0.71;3.36)	
Q3	401 (25)	66 (23)	1.07 (0.72;1.60)	22 (28)	1.85 (0.85;4.03)	
Q4	401 (25)	85 (30)	1.47 (0.96;2.26)	28 (35)	**2.35 (1.04;5.31)**	
p-trend			0.11		**0.04**	
1-SD increase			1.13 (0.96;1.33)		1.37 (1.02;1.82)	0.25
Prudent						
Q1	402 (25)	62 (22)	1	17 (22)	1	
Q2	401 (25)	72 (25)	1.02 (0.70;1.50)	19 (24)	1.06 (0.54;2.11)	
Q3	401 (25)	75 (26)	1.07 (0.72;1.57)	14 (18)	0.75 (0.35;1.59)	
Q4	401 (25)	79 (27)	1.08 (0.71;1.63)	29 (37)	1.45 (0.72;2.92)	
p-trend			0.69		0.41	
1-SD increase			1.02 (0.88;1.19)		1.20 (0.91;1.58)	0.32
Mediterranean						
Q1	402 (25)	64 (22)	1	18 (23)	1	
Q2	401 (25)	74 (26)	0.99 (0.68;1.44)	13 (16)	0.70 (0.34;1.46)	
Q3	401 (25)	83 (29)	1.04 (0.72;1.52)	22 (28)	1.06 (0.54;2.06)	
Q4	401 (25)	67 (23)	0.79 (0.52;1.20)	26 (33)	1.15 (0.57;2.32)	
p-trend			0.34		0.47	
1-SD increase			0.94 (0.81;1.09)		1.10 (0.83;1.45)	0.33

OR, odds ratio; 95% CI, 95% confidence interval; Q, quartile; SD, standard deviation.
[1]Multinomial-logistic regression models adjusted for age, sex, level of education, energy intake (kcal/day), body mass index (kg/m^2) with province of residence as a random effect.
[2]P-value for the heterogeneity of effects
In bold: P-trend< 0.05



T, tertile; BMI, body mass index. Numbers do not always add up due to missing data [1]P value for heterogeneity [2]Waist to hip ratio [3]Waist to hip ratio risk categories according to WHO criteria. [4]Physical activity, in the last 10 years, measured in METs/week: inactive (0), low (0.1-8), moderate (8-15.9) and very active (≥16).

Figure S1. Means and 95% confidence intervals (CI) of levels of adherence to the dietary patterns according to characteristics of controls of the MCC-Spain study.



OR, odds ratio; CI, confidence interval.[1]Crude model includes only province as random effects. [2]Model adjusted for age, sex, education, energy intake with province of residence as random effects.

Figure S2. Odds ratios of chronic lymphocytic leukemia for a 1-SD increase in dietary patterns adjusted for one factor at a time covariate of the final model, in the MCC-Spain study.

LIST S1 – list of collaborators

MCC-SPAIN STUDY

Institut Català d'Oncologia (ICO)-L'Hospitalet de Llobregat
Víctor Moreno, Paloma Quesada, Yasmin Sabater, Marleny Vergara, Ainara, Exposito, Teresa Alonso, Isabel Padrol, Joellen Klaustermeier, Yolanda Florencia, Vanesa Camon, Eva Domingo-Domenech, Dolores Dot, Anna Esteban, Elisabeth Guinó, Santi Mercadal, Ana Oliveira, Josep Sarrà.

ISGlobal- Centre for Research in Environmental Epidemiolog (CREAL), Barcelona, Spain
Mireia García, Cecília Persavento, Esther Gracia-Lavedan

Hospital Clínic, Barcelona, Spain
Cristina Capdevila Lozar, Ainara Expósito, Silvia Martin Román, Amparo Muñoz, Yolanda Torralba

Hospital del Mar, Barcelona, Spain
Eugènia Abella, Estela Carrasco, Judith Cirac, Francesc Garcia, Antonio Salar

Institut de Prestacions d'Assistència Mèdica al Personal Municipal (PAMEM) & Centros de Atención Primaria (CAP), Barcelona, Spain
Jesús Almeda, Marifé Alvarez Rodriguez, Alex Bassa Massanas, Albert Boada Valmaseda, Enric Duran, Olga Gonzalez Ferrer, Clara Izard, Manoli Liceran, Carmen López, Josep Manuel Benítez, Dolors Petitbó, Angelina Potrony, Sònia Sarret, Laura Sebastián, Josep M. Vilaseca

Instituto Universitario de Oncología, Universidad de Oviedo, Asturias, Spain
Cristina Arias, Guillermo Fernández-Tardón, Ana Fernández Somoano, Miguel García-Villarino, Carlos López-Otín,

Servicio de Salud del Principado de Asturias, SESPA, Asturias, Spain
Enrique Colado, Begoña Martínez-Argüelles, Manuel Rivas del Fresno, Marta María Rodríguez-Suárez.

Girona group
Unitat d'Epidemiologia i Registre de Cancer de Girona: Loreto Vilardell, Montse Puig-Vives, Gemma Osca-Gelis, M Carme Carmona-Garcia, Rocio Rodriguez Romanos, Carlota Torner Galindo, Patricia Martí Bargalló, Esther Rodriguez Sanchez, Marta Solans Margalef, Aina Roca Barceló, Raquel Comas Navarro, Marc Saez
Hospital Universitari de Girona Dr. Josep Trueta: Josep Maria Roncero, David Gallardo, Rosa Coll, Ignacio Blanco. *CAP de Santa Clara:* Conxa Bou
CAP de Angles: Gabriel Coll de Tuero, Alba Coll Negre

Granada group
University of Granada: Olmedo-Requena R, Olvera Porcel MC, Salcedo-Bellido I, Barrios-Rodríguez R, Jiménez-Moleón JJ;
Virgen de las Nieves,Universitary Hospital,Unit of Hematology: García-Martín P, Jurado-Chacón M.

Cantabria group
Inés Gómez-Acebo, Pilar González Echezarreta, Maria del Mar González Martínez, Luis Mariano López López, Almudena de la Pedraja Pavón, Paula Picón Sedano, Trinidad Dierssen-Sotos

Gipuzkoa-MCC group & Institutions
Pilar Amiano, Madalen Oribe, Mikel Azpiri, Ana Jimenez, Carmen Urtiaga, M. Jesús Mitxelena, Concepcion Mugarza, Irune Ruiz
Public Health Division of Gipuzkoa, Hospital Universitario Nª Sra de Aranzazu, Basque Health Department;.
Onkologikoa, Instituto Oncologico de Gipuzkoa