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The European Prospective Investigation into Cancer and Nutrition (EPIC)

Carlos A Gonzalez*
Department of Epidemiology, Institut Català d'Oncologia (ICO), Av. Gran Via s/n, km 2.7, 08907 L'Hospitalet, Barcelona, Spain

Abstract

Objective: To describe the main finding produced so far by the EPIC project, which aims to improve the scientific knowledge of nutritional factors involved in cancer.
Design and setting: Prospective cohort study in 23 centres from 10 European countries. Dietary assessment method varied by countries: in some cases a diet history by personal interview was carried out, while in most countries a self-administered semi-quantitative food-frequency questionnaire was used; in one case the questionnaire was combined with a food record. Information on a wide range of lifestyle factors and anthropometric measurements were also collected for most participants.
Subjects: The cohort includes 521 468 men and women mostly aged between 39 and 69 years, whereas blood samples are available for 387 889 subjects.
Results: To date 24 185 cancer cases have been identified in the follow-up of the cohort. The publications produced by each centre can be consulted on the EPIC website (http://www.iarc.fr/epic/). Among initial findings concerning the associations between cancer and dietary factors, one of the most important results is a protective effect of high fibre intake and fish consumption against colorectal cancer, while high red and processed meat intake increase the risk. Regarding lung cancer the first analyses found a protective effect of fruit intake but no association with vegetable consumption. No association was observed between vegetables and fruit intake and the risk of prostate cancer or breast cancer. Finally, data from Cambridge point to an interesting result regarding breast cancer: no association was observed with saturated fat intake measured by food-frequency questionnaire, but according to the food diary a daily intake of 35 g doubles the risk of breast cancer compared to women with daily intake of 10 g or less.

Keywords
Nutrition
Prospective studies
Cancer research
Dietary assessment methods
Colorectal cancer
Lung cancer
Breast cancer

Main characteristics

In spite of decades of epidemiological investigation, scientific evidence on the relationship between cancer at several sites and some foods is still insufficient or inconsistent and prevents the establishment of solid conclusions[1]. There are various reasons that may explain this situation: biologically relevant foods associated with cancer are ingested many years before tumour appearance, food habits are very difficult to measure with exactitude, and food-frequency questionnaires usually used contain important measuring errors[2]. The presence of recall bias, the lack of statistical power and/or the homogeneity of food habits among study participants are also important limitations. The European Prospective Investigation into cancer and Nutrition (EPIC) is realised with the goal of improving scientific knowledge on nutritional factors involved with cancer[3], and to contribute scientific bases for public health interventions directed in promoting a healthy diet and lifestyles. One of its greatest advantages is the wide range of variability in food intake, the product of large differences still observed today between Mediterranean countries (Greece, Italy and Spain) and the dietary patterns of Northern Europe, and its great statistical power, being one of the largest prospective cohort study realised in the world.

EPIC[4] started in 1993 with data and blood sample collection in 23 centres in 10 European countries (Fig. 1): Germany, Denmark, Spain, France, Greece, Holland, Italy, Norway, United Kingdom and Sweden, coordinated by the WHO's International Agency for Research on Cancer (IARC). In Spain, it is realised in five geographic areas (Asturias, Granada, Guipuzcoa, Murcia and Navarra) coordinated by the Catalan Institute of Oncology's Epidemiological Department. The European cohort is formed by 521 468 individuals (of which 366 521 are women) mostly between the ages of 34 and 69 years. For

**Corresponding author:* Email cagonzalez@ico.scs.es
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	Subjects included	
	Questionnaire	Q+Blood
France	74 524	21 053
Italy	47 749	47 725
Spain	41 440	39 579
UK	87 942	43 141
Netherlands	40 072	36 318
Greece	28 555	28 483
Germany	53 091	50 678
Sweden	53 826	53 781
Denmark	57 054	56 131
Norway	37 215	11 000
All	521 468	387 889

Fig. 1 EPIC collaborating centres and cohort subjects

biochemical, hormone and genetic analyses, 387 889 blood samples are available.

Based on validation study results, various diet measurement methods were adopted, to suit the needs of each country, that include: self-administered semi-quantitative food-frequency questionnaires (with approximately 260 food items), diet history questionnaires (with more than 600 food items) administered by means of interviews and semi-quantitative food-frequency questionnaires combined with a food record. Also a 24-hour recall was applied by means of a computerised program (EPIC-SOFT) in a sub-sample of 8%, to calibrate the dietary measuring instruments, with the objective of correcting systematic errors produced by the over- or underestimation of intakes[5]. A wide range of information was gathered on habits, lifestyles and medical history. Height, weight and waist and hip circumference were measured, and blood samples were obtained, the majority conserved in liquid nitrogen. To date, 24 195 cases of cancer (7272 in men and 16 923 in women) have been identified by means of the computerised link with population-based cancer registries, except in Greece, France and Germany, where active follow-up is being realised. After various years of work, a standardised food composition table (EPIC Nutrient Database–ENDB) for the 10 participating countries is almost complete.

Principal results obtained to date

The publications realised by each centre based on information gathered with the EPIC cohort of each country can be consulted on the EPIC website (http://www.iarc.fr/epic/) and the specific EPIC Spain on our website (http://www.epic-spain.com/). The first important results on the comparison of food intake in each centre have been published in a supplement of *Public Health Nutrition*[6]. In relation to fruit and vegetable intake a wide variation was observed, with greater intake in the south of Spain (Murcia and Granada) and lower intake in Sweden and Norway. The main initial findings on the association between food intake and the most frequent tumours are the following (Table 1). Regarding prostate cancer in 1104 incident cases, no association with fruit and vegetable intake was observed[7]. EPIC results confirmed previous scientific evidence that indicate that this association was not very probable. Regarding colorectal cancer the protective effect of an elevated fibre intake[8] was confirmed. The results are of great scientific importance, since results of other cohorts, especially those from the USA, questioned the protective effect of fibre. On the other hand, a significant negative association between nut and seed intake was observed for colon cancer in women[9]. Also, the preliminary analysis of an elevated fruit and vegetable intake shows their protective effect on the risk

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Table 1 Food intake and cancer. Main initial findings of EPIC for most frequent tumours

Cancer site	Number of cases	Results	Reference
Prostate	1104	Fruits: no association Vegetables: no association	7
Lung	860	Fruits: negative association Vegetables: no association	11
Colon and rectum	1065	Dietary fibre: negative association	8
	528*	Nuts and seeds: negative association in women	9
	1329	Fish: negative association Red and processed meat: positive association	10
Breast	168†	Fat intake: positive association (using a dietary record)	12
	3659	Vegetables: no association Fruits: no association	13

* Colon cancer cases in women.
† Only in EPIC Norfolk.

of suffering colorectal cancer. Elevated fish intake has a protective effect while red meat and specially processed meats increase risk[10]. Regarding lung cancer, a first analysis of 860 incident cases observed[11] a protective effect by fruit intake and no association with vegetable intake, which also confirms previous scientific evidence available. Lastly, regarding breast cancer, although definite EPIC results are not yet available on the controversial possible association with saturated fat intake, EPIC data from Cambridge[12] show extremely interesting results. It has been observed at this centre that when the association is measured with the food-frequency questionnaire, no association with saturated fat intake was observed, but according to the dietary diary, a daily intake around 35 g doubles the risk of suffering breast cancer in comparison to women with a daily intake of 10 g or less. Finally, we found that the total or specific vegetables and fruit intake is not associated with the risk for breast cancer[13].

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