

Editorial

The European Prospective Investigation into Cancer and Nutrition (EPIC) is a prospective multi-centre cohort study aimed at investigating the role of dietary, lifestyle, genetic, and metabolic factors in the development of cancer and other chronic diseases. It was initiated in 1992 with the recruitment of more than half a million participants from ten European countries, and the collection of detailed data on lifestyle and health and anthropometric measurements. In addition blood samples were drawn and stored for future studies on metabolic and genetic characteristics. From the baseline data collection through 2009, more than 63,000 EPIC participants have been diagnosed with cancer, approximately 14,000 with diabetes and 12,000 with Myocardial infarction.

EPIC has contributed to increase the scientific knowledge on the effects of fruit, vegetable and cereal consumption on health. In the last decade, EPIC has generated more than 400 dedicated articles in peer-reviewed journals, and an important part of these publications emerge from research on the association between the consumption of fruit and vegetables, dietary patterns rich in plant foods (i.e. Mediterranean diet), or nutrients provided by these foods (i.e. fibre) and risk of developing chronic diseases.

In this newsletter, recent publications based on the EPIC cohort focussed on the association between fruit and vegetable consumption and several health outcomes are reviewed. Data of the Italian branch of EPIC, a Mediterranean population characterized by a high and varied consumption of plant foods, reported that the consumption of vegetables was associated with a reduction in the risk of developing breast cancer. Results of the EPIC-PANACEA study, conducted among 373,803 EPIC participants, showed that fruit and vegetable consumption was not associated with weight change in the overall sample; however high fruit and vegetable consumption was associated with a lower weight gain in those who quit smoking during follow-up. Finally, the EPIC-DiOGenes study based on data from five EPIC countries, demonstrated that fruit consumption, mostly when consumed as part of a healthy dietary pattern, was associated with a lower increase in abdominal adiposity, measured as the gain in waist circumference that was independent of the concurrent gain in body mass index.

As stated by the authors of these studies, these findings have important public health implications: first, vegetable consumption is one of the few modifiable risk factors for breast cancer that have been documented; at such, plant food consumption should be promoted for cancer prevention, in line with current dietary guidelines. Secondly, given that weight gain is an important contributor to relapse after smoking cessation, those who quit smoking should be encouraged to follow a diet rich in fruit and vegetable to maintain a healthy weight. And finally, although fruit and vegetable consumption seems not to be associated with midterm weight change in this observational study, it might be possible that plant foods, and specifically fruit intake, has specific effects on the distribution of body fatness, reducing the accumulation of abdominal fat mass which seems to encompass the major disease risk associated with obesity.

Elio Riboli

Professor of Cancer Epidemiology & Prevention, Head- School of Public Health
Faculty of Medicine - Imperial College London



- E. Bere • University of Agder • Faculty of Health and Sport • Norway
- E. Birlouez • Epistème • Paris • France
- I. Birlouez • INAPG • Paris • France
- MJ. Carlin Amiot • INSERM • Faculté de médecine de la Timone • Marseille • France
- B. Carleton-Tohill • Center for Disease Control and Prevention • Atlanta • USA
- V. Coxam • INRA Clermont Ferrand • France
- N. Darmon • Faculté de Médecine de la Timone • France
- H. Bas Bueno de Mesquita • National Institute for Public Health and the Environment (RIVM) • Bilthoven • Netherlands
- ML. Frelut • Hôpital Saint-Vincent-de-Paul • Paris • France
- T. Gibault • Hôpital Henri Mondor • Hôpital Bichat • Paris • France
- D. Giugliano • University of Naples 2 • Italy
- M. Hetherington • University of Leeds • UK
- S. Jebb • MRC Human Nutrition Research • Cambridge • UK
- JM. Lecerf • Institut Pasteur de Lille • France
- J. Lindstrom • National Public Health Institute • Helsinki • Finland
- C. Maffei • University Hospital of Verona • Italy
- A. Naska • Medical School • University of Athens • Greece
- T. Norat Soto • Imperial College London • UK
- J. Pomerleau • European Centre on Health of Societies in Transition • UK
- E. Rock • INRA Clermont Ferrand • France
- M. Schulze • German Institute of Human Nutrition Potsdam Rehbruecke, Nuthetal • Germany
- J. Wardle • Cancer Research UK • Health Behaviour Unit • London • UK



IFAVA Contacts info

HEAD OFFICE
International Fruit And Vegetable Alliance
c/o Canadian Produce Marketing Association
162 Cleopatra
Ottawa, Canada, K2G 5X2

IFAVA CO-CHAIR
Paula Dudley - New Zealand
e-mail : paula@5aday.co.nz

IFAVA CO-CHAIR
Sue Lewis - Canada
e-mail : slewis@cpma.ca

Board of Directors

- S. Barnat • Aprifel • France
- L. DiSogra • United Fresh • USA
- C. Doyle • American Cancer Society • USA
- P. Dudley • Co-Chair • United Fresh • New Zealand
- E. Pivonka • Fruits & Veggies - More Matters • USA
- R. Lemaire • Fruits and Veggies - Mix it up!™ • Canada
- S. Lewis • Co-Chair • Fruits and Veggies - Mix it up!™ • Canada
- C. Rowley • Go for 2&5® • Horticulture • Australia
- V. Toft • 6 a day • Denmark

Scientific Clearing House Committee

- S. Barnat • Aprifel • France
- E. Pivonka • Fruits & Veggies - More Matters • USA
- C. Rowley • Go for 2&5® • Horticulture • Australia • Australia

Food composition of the diet in relation to changes in abdominal obesity

— Dora Romaguera on behalf of EPIC-DiOGenes investigators —

Department of Epidemiology and Biostatistics, School of Public Health, Imperial College London, UK

Abdominal adiposity: a stronger marker to predict survival

Body mass index (BMI^a) is normally used in epidemiological studies as a marker of total adiposity, whereas waist circumference (WC^b) is used as a marker of body shape and fat distribution. Recent epidemiological studies have demonstrated that when both WC and BMI are included simultaneously in statistical models, WC adjusted for BMI (or “WC for a given BMI”) is more strongly related to disease risk than BMI or WC alone. For instance, among individuals with the same BMI, even within the normal range of BMI, those with higher WC showed a lower survival, suggesting that “WC for a given BMI” may capture the specific effect of the abdominal fat mass¹. Given the widely recognized effects of abdominal adiposity on health, the understanding of how diet can modulate changes in the phenotype “WC for a given BMI” (WCBMI) is deemed necessary. The aim of the present study was to ascertain the association between specific food groups/items consumption and changes in WCBMI, i.e. changes in WC that are independent of concurrent changes in BMI.

The current study² included participants from five countries involved in the European Prospective Investigation into Cancer and Nutrition (EPIC) study, participating in the DiOGenes (Diet, Obesity and Genes) project, namely Italy, United Kingdom, the Netherlands, Germany and Denmark (n = 48,631). At baseline (between 1992–1998), participants filled out extensive questionnaires covering their diet, lifestyle, and medical history, and anthropometric measurements were obtained. Updated information on anthropometric data has been obtained from EPIC participants through follow-up examinations during 1998–2005 (median follow-up time 5.5 years). The outcome of interest in the present study was the change over time of WC that is independent of the concurrent change in BMI, i.e. gains in WC over and above a given gain in BMI, likely to represent the specific accumulation of abdominal fat mass. For that we defined the phenotype WCBMI (cm/year) both at baseline and at follow-up as the residual values from the gender- and centre-specific regression equations of WC on BMI^c. Annual changes in this phenotype (Δ WCBMI) were calculated as (follow-up WCBMI – baseline WCBMI) / follow-up time³. The association between dietary variables and Δ WCBMI (in cm/year) was modelled using multi-adjusted linear regression analyses.

a. BMI is calculated as weight in kg divided by the squared height in meters.

b. WC in cm is normally measured at the waist line using a tape.

c. Calculating the residuals of WC regressed on BMI is a way of adjusting WC for BMI.

Higher consumption of fruit and dairy lowers the increase of abdominal adiposity

Of all food groups considered, six food groups were found to be significantly associated with Δ WCBMI in a consistent way in both men and women. Fruit and dairy product consumption were inversely associated with gains in WCBMI, indicating that a higher consumption of fruit and dairy was associated with a lower increase of abdominal adiposity. On the other hand, consumption of white bread, processed meat, margarine, and soft drinks were all positively associated with Δ WCBMI, indicating that higher consumption of these foods was associated with greater gains in abdominal adiposity. The lowest gain of abdominal adiposity was observed when either dairy products or fruits substituted the consumption of soft-drinks.

In order to better translate these findings into public health messages that encourage overall healthy diets we constructed a summary score of our results. Overall it was estimated that those following a diet characterized by high fruit and dairy products and low white bread, processed meat, margarine, and soft drinks consumption, would show 1.1 cm less gain in WC for a given gain in BMI during a 10 years period, compared to those with a diet with opposite characteristics.

A whole dietary pattern for a lower accumulation of abdominal fat mass

In the present study we have observed that among European men and women, a dietary pattern characterized by a high consumption of fruits and dairy products, and a low consumption of white bread, processed meat, margarine, and soft drinks was associated with a lower gain in WC independently of concurrent gains in BMI, likely to represent a lower accumulation of abdominal fat mass. In addition, this study supports that a whole dietary pattern incorporating simultaneously several food recommendations may yield further benefits on health – in this case prevention of abdominal fat accumulation, compared to the effect of its single components, and hence recommendations should encourage an overall healthy diet.



REFERENCES:

1. Pischon T, Boeing H, Hoffmann K, Bergmann M, Schulze MB, et al. (2008) General and abdominal adiposity and risk of death in Europe. *N Engl J Med* 359: 2105–2120.

2. Romaguera D, Angquist L, Du H, Jakobsen MU, Forouhi NG, et al. (2011) Food composition of the diet in relation to changes in waist circumference adjusted for body mass index. *PLoS One* 6: e23384.

3. Romaguera D, Angquist L, Du H, Jakobsen MU, Forouhi NG, et al. (2010) Dietary determinants of changes in waist circumference adjusted for body mass index – a proxy measure of visceral adiposity. *PLoS One* 5: e11588.

Fruit and vegetable consumption and weight gain in European men and women

— Anne-Claire Vergnaud on behalf of EPIC-PANACEA investigators —

Department of Epidemiology and Public Health, Imperial College London, London, United Kingdom

Fruit and vegetables have been suggested to help prevent excessive weight gain during adult life. Their low energy density and high content of water and fiber could enhance satiation signals. Previous studies investigating this relation have been inconsistent so far. Several prospective observational studies and intervention studies have shown an inverse association between fruit and vegetable consumption and weight change. However, individuals who eat higher quantities of fruit and vegetables also tend to eat less meat, especially processed meat, saturated fat, and refined carbohydrates, all of which have been positively associated with weight gain. Therefore, it remains unclear whether the associations previously observed were fully attributable to fruit and vegetable intake itself or to an underlying dietary pattern. In addition, most previous observational studies were performed in small- to medium-size national samples. Homogenous dietary intakes and limited sample sizes could have reduced their power to observe an association, especially when studying specific subgroups of participants. We aimed to investigate whether higher intakes of fruit and vegetables were related to subsequent midterm changes in body weight in 373,803 men and women participating to the EPIC project.

Overall, fruit and vegetable intakes measured at baseline were not associated with weight change in both men and women after an average of five years of follow-up¹. Fruit intake did not include nuts, olives, and fruit juices and vegetable intake did not include legumes, potatoes, and other tubers. We excluded participants who were likely to have modified their diet before baseline or to have misreported energy intakes. We also took into account physical activity, dietary pattern and other life style factors in our analysis. In addition, measurement error of diets has been partially corrected thanks to a randomized dietary calibration study. This result was in agreement with a recent review concluding that fruit and nonstarchy vegetables were not associated with amounts of subsequent excess weight gain and obesity².

However, fruit and vegetable intakes were inversely associated with weight change in participants who quit smoking during follow-up.

This association had previously been reported in a sub-sample of the EPIC cohort³ but no other prospective cohort studied this subgroup specifically. This finding will need further investigation. If confirmed in other populations, it may have important public health implications because weight gain after smoking cessation is a frequent reason for relapse.

Several comments must be made on the present study:

First, weight at follow-up was self-reported in most centers and was therefore corrected with the use of a prediction equation to improve its accuracy. Concordant results were observed in the two centers with measured weights at both baseline and follow-up, which indicated that the observed associations were unlikely to be due to misreporting of weight only. Second, we only measured diet at baseline and could not rule out that residual confounding related to changes in diet during follow-up remained in our analyses. The time sequence between the change in diet and change in weight is critical in observational studies, and reverse causation may remain even when diet is measured at both baseline and follow-up. Finally, despite a high response rate at follow-up (80%), nonresponse was more likely in participants who reported a poorer health and unhealthy lifestyle, especially a low BMI or high BMI. This selection bias could have limited the generalizability of our results.

We resolved some of the limits encountered by previous studies investigating the association between fruit and vegetable consumption and weight change in free living subjects. The very large sample size and heterogeneity of both dietary behaviours and obesity prevalence increased our statistical power to detect small associations and allowed us to explore a variety of interaction factors including change of smoking status. We also took into account for the first time the potential confounding effect of underlying dietary patterns and our results were not modified. We concluded that higher baseline fruit and vegetable intakes, while maintaining total energy intakes constant, did not substantially influence midterm weight change overall but could help to reduce risk of weight gain in persons who stop smoking.



REFERENCES:

1. Vergnaud AC, Norat T, Romaguera D, et al. Fruit and vegetable consumption and prospective weight change in participants of the European Prospective Investigation into Cancer and Nutrition-Physical Activity, Nutrition, Alcohol, Cessation of Smoking, Eating Out of Home, and Obesity study. *Am J Clin Nutr* 2012; 95(1): 184-93
2. Summerbell CD, Douthwaite W, Whittaker V, et al. The association

between diet and physical activity and subsequent excess weight gain and obesity assessed at 5 years of age or older: a systematic review of the epidemiological evidence. *Int J Obes (Lond)* 2009; 33 Suppl 3: S1-92

3. Buijsse B, Feskens EJ, Schulze MB, et al. Fruit and vegetable intakes and subsequent changes in body weight in European populations: results from the project on Diet, Obesity, and Genes (DiOGenes). *Am J Clin Nutr* 2009.

Fruit and vegetables consumption and breast cancer risk in Italy

— Giovanna Masala —

Molecular and Nutritional Epidemiology Unit
ISPO Institute for Cancer Research and Prevention. Florence, Italy

The evidence of a protective effect of vegetables and fruit on breast cancer (BC) is mostly based on case-control studies while, so far, prospective studies have provided weaker or no evidence of this effect.

A prospective study in a Mediterranean Country

A large variety of specific vegetables and fruit are traditionally consumed by Mediterranean populations, often in large amounts, thus offering the opportunity to evaluate in a favourable setting the effects of specific types of these foods. We have evaluated the relationship between vegetables and fruit consumption and BC risk in the Italian cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC) study. The Italian section of the EPIC study includes five cohorts (Turin, Varese, Florence, Naples and Ragusa) and enrolled, in the period 1993-1998, more than 32.000 adult women. According to the common EPIC protocol, information about diet and life-style habits, anthropometric measurements and a blood sample were collected for each participant, after signature of an informed consent form.

The collection of information on dietary habits

Usual diet was investigated through Food Frequency Questionnaires specifically developed to capture local dietary habits typical of the Italian population in different areas of the country. The absolute frequency of consumption of each item is assessed asking the number of times a given food item is consumed (per day, week, month or year). The quantity of the food consumed is assessed through the selection of an image of a food portion, or by selection of a predefined standard portion when no image is provided. For some types of fruits (e.g. citrus) and vegetables (such as raw tomatoes and cabbages), whose consumption in Italy is strongly dependent on season, intake is assessed separately in and out of the main cropping season of typical consumption.

The total vegetables consumption category included all sorts of raw and cooked fresh vegetables. Specific subgroups considered were: leafy vegetables (salad greens, chard, spinach and other leafy greens); tomatoes (raw and cooked); other fruiting vegetables (peppers, artichokes, aubergine, courgette, green beans, fennel, celery); root vegetables

(including carrots and red beetroot); cabbages (including broccoli, brussel sprouts, cauliflower, black cabbage and savoy cabbage); onions, garlic and leek; mushrooms. The total fruit consumption category included all sorts of fresh fruits (analysed also separately as citrus fruit and other fruit), nuts and seeds and dried and canned fruits as well.

Increasing consumption of vegetables was inversely associated with the risk to develop breast cancer

After a median follow up of approximately 11 years, 1,072 newly diagnosed BC cases were identified and included in the analyses. Analyses adjusted for known or potential risk factor for BC (education, anthropometry, reproductive history, Hormone Replacement Therapy, physical activity, alcohol consumption and smoking habits) showed an inverse association between consumption of "all vegetables" and BC risk. Women in the highest (>264.8 g/day) in comparison with women in the lowest quintile (<107.8 g/day) of consumption have a 35% significant reduction in risk. An inverse association also emerged for increasing consumption of "leafy vegetables", either cooked or raw, (with a reduction of 30% in risk among women in the highest in comparison with women in the lowest quintile of consumption) and of fruiting vegetables. An inverse association also emerged with increasing consumption of raw tomatoes, a major component of mixed salads in this Italian population, together with lettuce and other raw leafy vegetables. For other vegetables, the point estimates suggested a possible inverse association with BC risk, although no statistically significant associations emerged. No association for fruit, overall or by subtypes, with BC risk was found.

Our results support an inverse association between increased consumption of vegetables, overall and of specific subtypes (namely leafy vegetables, either cooked or raw), and BC risk. The public health implications of a beneficial effect of vegetables on breast cancer, for which only a few modifiable risk factors have been so far identified, are relevant. These results warrant further investigation in order to better understand the specific effects of a high consumption of vegetables in the context of the Mediterranean diet.



BASED ON:

Masala G, Assedi M, Bendinelli B, Ermini I, Sieri S, Grioni S, Sacerdote C, Ricceri F, Panico S, Mattiello A, Tumino R, Giurdanella MC, Berrino F, Saieva C, Palli D. Fruit and vegetables consumption and breast cancer risk: the EPIC Italy study. *Breast Cancer Res Treat.* 2012; 132:1127-36. Epub 2012 Jan 4.