

# ABSTRACT BOOK



First Edition

## INTERNATIONAL CONFERENCE ON HEALTH BENEFITS OF MEDITERRANEAN DIET

Highlights on Cancer & Cardiovascular Diseases

Capsis Convention Center  
Aghia Pelagia, Crete

## June 5-8, 2003

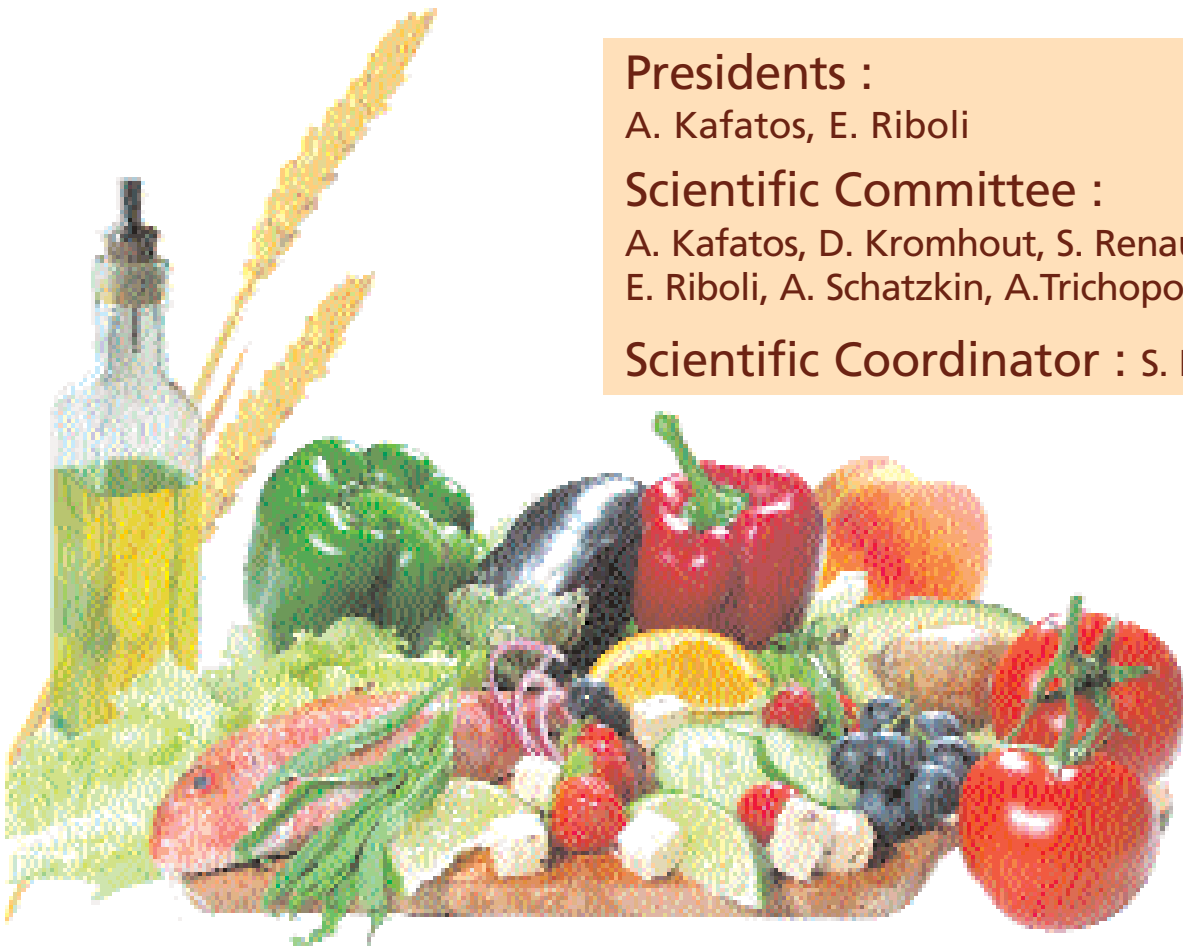
Presidents :

A. Kafatos, E. Riboli

Scientific Committee :

A. Kafatos, D. Kromhout, S. Renaud,  
E. Riboli, A. Schatzkin, A. Trichopoulou

Scientific Coordinator : S. Barnat





*Anthony Kafatos, MD*

*Professor, Director of Preventive Medicine and Nutrition Clinic  
University of Crete School of Medicine*

Nutrition is recognized as a major health determinant. Unhealthy diets and sedentary lifestyles are critically implicated in cardiovascular diseases and various cancers, and underpin the increasing burden of chronic diseases in Europe /worldwide - notably the escalating prevalence of obesity among children and adults. This Symposium on the Mediterranean Diet, organized by Aprifel, is therefore timely in addressing issues of critical significance to public health. It is also timely given the state of public debate between scientists, policy-makers and citizens on appropriate nutritional recommendations for health. On the one hand, the prospects of a coherent nutrition policy (for Europe) appear tantalizing close with the convergence of evidence based policy recommendations from the EUROMED project, the Action Plan produced by the SFSP during the French Presidency of the EU in 2000, the promise of a Community Action Plan on Nutrition embodied in the Commission's White Paper on Food Safety and, most recently, the WHO Action Plan on Nutrition. On the other hand, in the eyes of many citizens, the credibility of the science underlying accepted guidelines is currently being challenged by the widely publicized controversy as to the health benefits of high-fat vs low-fat dietary recommendations. The Symposium provides us with an opportunity to evaluate the most recent scientific evidence on the health properties traditionally associated with the 'Mediterranean diet' and in so doing to re-assess/debate the bases for a coherent approach to the promotion of healthy diets and lifestyles.

The location of the Symposium in Crete is particularly appropriate since the Mediterranean diet of Crete has a richly documented history stretching back over 4000 years to the Minoan era. Moreover, the health properties attributed to the traditional Cretan diet have been - and continue to be - the source of scientific and popular interest for nearly half a century. The Symposium addresses a broad range of themes : components of the Mediterranean diet; epidemiological, clinical and biochemical studies of cancers and of cardiovascular diseases; interactions between the Mediterranean diet and genetic and lifestyle factors; the current status, prospects and dietary recommendations to be derived from the Mediterranean diet. We are confident that the outcomes of this Symposium will contribute significantly to the development of coherent nutritional recommendations for good health.

*Anthony Kafatos*

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# PROGRAMME

## Thursday, June 5<sup>th</sup>, 2003

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18.00 **Registration**

19.00 **Official Opening and Welcome**

*L. Damiens* : Director of Aprifel

*Pr. N. Siafakas* : Vice Rector of the University of Crete

*Pr. N. Gourtsoyiannis* : Dean of the Medical School of Crete

*S. Barnat* : Head of the Scientific Department, Aprifel

### Opening Lectures

Why we need a European nutritional policy

*A. Kafatos* - Greece

Diet and overall survival

*A. Trichopoulou* - Greece

The epidemiology of cardiovascular diseases in Europe

*D. Kromhout* - Netherlands

### Special Lectures : *Dr. F. Sicard*

European Commission,  
Health and Consumer Protection  
Directorate General.

Public Health Directorate, Unit G3  
(Health promotion, Health monitoring  
and injury prevention).

Luxembourg

21.00 **Opening dinner** \_\_\_\_\_

## Friday, June 6<sup>th</sup>, 2003

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Chairmen :

*A. Trichopoulou* / *A. Schatzkin*

9.00 **Introduction :**

Components of the Mediterranean diet

*A. Trichopoulou*

9.10 Mediterranean diet at present

*A. Naska* - Greece

9.45 Do dietary patterns actually vary across the 10 western European populations participating to the EPIC study?

*N. Slimani* - IARC-WHO

**Session 1 : Mediterranean diet and cancers : epidemiology, clinical and mechanisms of actions**

10.20 Consumption of fruit and vegetables and prevention of cancers of the digestive tract : Results from EPIC and other studies

*E. Riboli* - IARC-WHO

11.00 Break \_\_\_\_\_

11.20 Fiber and Colorectal Cancer Prevention

*A. Schatzkin* - USA

11.55 Folate and cancer

*S.E. Vollset* - Norway

12:30 The use of biomarkers to validate reported dietary intake

*P. Van't Veer* - Netherlands

13:05 **Discussion**

13:30 **Conclusion**

*A. Schatzkin*

19:30 **Poster session / Cocktail**

Annoucement of the session's selected poster

21:00 **Gala dinner** \_\_\_\_\_

## Saturday, June 7<sup>th</sup>, 2003

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Chairmen :

*S. Renaud / D. Kromhout*

### Session 2 : The Mediterranean diet and coronary heart disease

9.00 **Introduction :**

*D. Kromhout* - Netherlands

9:35 Cretan diet to prevent clinical manifestation of coronary heart disease  
*S. Renaud* - France

10:10 Ventricular, Atrial fibrillation and Cretan diet  
*D. Lanzmann* - France

10:45 Fruit and vegetables and fatal Myocardial Infarction  
*R. Saracci* - IARC/WHO

11:20 Break \_\_\_\_\_

11:50 Meat and fish and fatal Myocardial Infarction  
*T. Norat* - IARC/WHO

12:25 Mediterranean dietary pattern and cardiovascular disease in Italy  
*S. Panico* - Italy

13:00 The Med-RIVAGE intervention study on Mediterranean diet and risks for coronary heart disease  
*M. Gerber / D. Lairon* - France

13:30 **Conclusion**  
*S. Renaud*

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14:00 **Picnic Lunch for a special session :**  
/15:20 Alkalinizing effects of fruits, vegetables and potatoes  
*Ch. Remesy* - France

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15:30 **EPBH - Network meeting**  
/18:30 (for members only)

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19:30 **Poster session / Cocktail**  
Annoucement of the session's selected poster

## Sunday, June 8<sup>th</sup>, 2003

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Chairmen :

*E. Riboli / S. Vollset*

### Session 3 : Mediterranean diet : genetics ? lifestyle factors ?

9.00 **Introduction :**

*S. E. Vollset* - Norway

9:30 Diet, lipid metabolism and genes : interactions in the aetiology of cardiovascular disease  
*D. Lairon* - France

10:05 Childhood, obesity and physical activity

*A. Kafatos* - Greece

10:40 Social analysis of the Mediterranean diet  
*F. Aubaile-Sallenave* - France

11:15 Break \_\_\_\_\_

11:40 Selected Poster Presentations

12:00 **Open talk :**

Mediterranean diet today : Changes ? Habits ? Adaptations ? Misinterpretations ? Recommendations ?

Modarated by: *Morten Strunge Meyer* (Danish Cancer Society)

With the participation of :

*A. Kafatos, D. Kromhout, S. Renaud, E. Riboli, A. Schatzkin, A. Trichopoulou and P. Van't Veer*

13:30 **Conference ending lecture**  
*E. Riboli*





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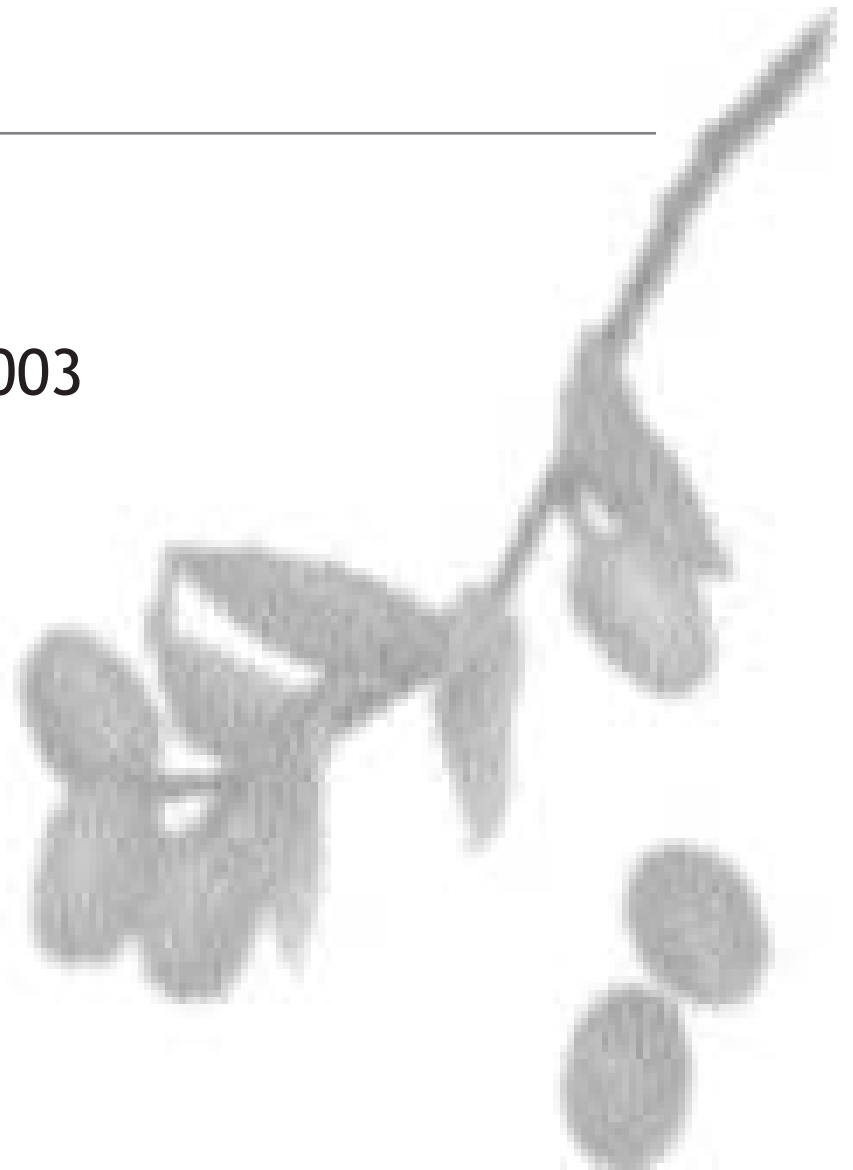
# *OPENING LECTURES*

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Thursday, June 5<sup>th</sup>, 2003

7:00 pm

*Minos Conference Room*





## Anthony KAFATOS (Greece)

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### BIOGRAPHICAL SKETCH

- AG Kafatos is Professor of Preventive Medicine and Nutrition of the Medical School of the University of Crete and Director of the Preventive Medicine and Nutrition Clinic.
- He is also chairman of the Department of Social Medicine of the Medical School.
- He is the representative of Greece in the committee on Health Promotion, Information, Education and Training in European Community.
- He has participated in and coordinated a number of international collaborative studies in Europe and in the USA.
- Pr. Kafatos has acted as an expert consultant on nutrition for the WHO and the FAO.

### RECENT PUBLICATIONS

- *Overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece.*  
 BMC Public Health. 2003 Jan, 3(1):3.
- *Extra virgin olive oil phenols and markers of oxidation in Greek smokers: a randomized cross-over study.*  
 Eur J Clin Nutr. 2002 Oct, 56(10):1024-9.
- *Calcium intake in relation to diet and health indicators in Cretan primary and high school pupils, Greece.*  
 Int J Vitam Nutr Res. 2002 Jul, 72(4):264-77.
- *Health and nutrition education in primary schools of Crete: changes in chronic disease risk factors following a 6-year intervention programme.*  
 Br J Nutr. 2002 Sep, 88(3):315-24.

## WHY WE NEED A EUROPEAN NUTRITIONAL POLICY

*Anthony KAFATOS, University of Crete*

The reasons why we need a European nutritional policy are clear-cut. First : nutrition is recognized as a key health determinant. Poor diets are directly related to the increasing burden of chronic, non-communicable diseases in Europe, notably cardiovascular diseases and various cancers, obesity and its co-morbidities, and osteoporosis. Second: food and nutrition are 'cross-cutting' issues in a fundamental sense. That is : dietary choices are affected not only by cultural influences and individual food preferences, but also by socioeconomic and environmental factors which are, in turn, shaped by a wide range of national and Community policies (eg policies impacting on the availability of foods and prices, quality, safety and so on, such as agricultural and fisheries policies, consumer protection, trade and industry, etc).

The need for a European nutrition policy has been widely recognized in a number of recent initiatives; politically the most significant being the Commission's White Paper on Food Safety (2000) followed by a Council Resolution on health and nutrition (23.01.2001)<sup>1</sup>. But momentum within the EU appears to have stalled and rather than the anticipated action plan geared to 'the development of a comprehensive and coherent nutrition policy'<sup>2</sup>, we have a Status Report on the European Commission's work in the field of nutrition in Europe (October 2002). We have, however, commitment in another context: in the recently endorsed WHO European Region Action Plan for food and nutrition policy<sup>3</sup>, which provides a framework of 3 inter-related strategies for food safety, nutrition and food security.

In short : the need for a European nutrition policy is clearcut. At issue now are the components of that policy and the measures required in formulating and implementing it in such a way as to effectively 'protect and promote health and reduce the burden of food-related diseases, while contributing to socio-economic development and a sustainable environment'.(WHO 2001).

<sup>1</sup>OJ C 020, 23.01.2001.

<sup>2</sup>White paper on food Safety, COM (1999) 719 final (para 106).

<sup>3</sup>The First Action Plan for Food & Nutrition Policy. WHO European region 2000-2005. World Health Organization (2001)



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### BIOGRAPHICAL SKETCH

- Antonia Trichopoulou is a Medical Doctor, State (Hellenic) Boards in Microbiology and Clinical Chemistry, Master of Public Health and currently Associate Professor of Preventive Medicine and Nutrition at the University of Athens Medical School.
- She was president of the Federation of the European Nutrition Societies. She is the director of the World Health Organization Collaborating Center for Nutrition at the Department of Hygiene and Epidemiology, School of Medicine, University of Athens.
- Antonia Trichopoulou's research focuses on various aspects of nutrition and particularly issues concerning the Mediterranean diet. She received in 2002 the IV Grande Covian Award for her work and her contribution to the knowledge and the promotion of the Mediterranean diet.

### RECENT PUBLICATIONS

- *Lipid, protein and carbohydrate intake in relation to body mass index.*  
Eur J Clin Nutr 2002, 56(1):37-43.
- *Consumption of added fats and oils in EPIC.*  
IARC Sci Publ. 2002, 156:213.
- *Nutritional epidemiology of cancer: accomplishments and prospects.*  
Proc Nutr Soc. 2002 May, 61(2):217-22.
- *Tracing the Mediterranean diet through principal components and cluster analyses in the Greek population*  
Eur J Clin Nutrition (in press).



## DIET AND OVERALL SURVIVAL

*Antonia Trichopoulou. M.D., Medical School, University of Athens*

The diet of the Mediterranean people has received increased attention in recent years because of ecological and analytical evidence, indicating that it may be inversely associated with coronary heart disease and several forms of cancer. Moreover, in several studies there have been indications that Mediterranean diet promotes longevity. Yet, three important questions need first to be addressed: what the dietary patterns are? Why should we consider dietary patterns instead of foods and nutrients? and, how can we trace dietary patterns in general population groups?

The role of diet in the causation of many diseases including coronary heart disease and several forms of cancer has been extensively studied and many food groups, foods, or nutrients with beneficial or detrimental effects have been identified. Fewer investigations have focused on the role that particular dietary patterns may play in health and disease, possibly because it is difficult to assess or even define a dietary exposure pattern.

Dietary patterns have the ability to integrate complex or subtle interactive effects of many dietary exposures and bypass problems generated by multiple testing and the high correlations that may exist among these exposures.

Indicators of dietary patterns may be developed *a priori* on the basis of previous knowledge concerning the favorable or adverse health effects of various dietary constituents, although from a quantitative point of view, they can be thought of as arbitrary or subjective. Dietary patterns may also be described *a posteriori* on the basis of existing data. Principal component and factor analyses have both been popular statistical techniques for the *a posteriori* identification of dietary patterns. The two approaches are closely related, their main difference being that factor analysis assumes a statistical model for the existing data set, whereas principal component analysis is mainly a mathematical method, and does not rely on statistical assumptions.



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### BIOGRAPHICAL SKETCH

- Daan Kromhout studied Human Nutrition at Wageningen University and obtained his MSc-degree in 1974. In 1978 he received a PhD-degree for an epidemiologic study on diet and risk factors for coronary heart disease in Dutch schoolchildren.
- In 1981 he received a MPH in Epidemiology from the University of Minnesota.
- In 1988 he became the head of the Department of Epidemiology of the National Institute of Public Health and the Environment (RIVM) in Bilthoven and in 2002 director of the Nutrition and Consumer Safety Division of that institute.
- Pr. Kromhout is the principal investigator of the Zutphen Study, a prospective study on diet, risk factors and cardiovascular diseases which forms the Dutch contribution to the Seven Countries Study.

### RECENT PUBLICATIONS

- *Prevention of coronary heart disease. Diet, lifestyle and risk factors in the Seven Countries Study.*  
Kluwer Academic Publishers, Norwell, MA, USA and Dordrecht, The Netherlands.  
ISBN 1-4020-7124-8. 2002, 1-267.
- *Prevention of coronary heart disease by diet and lifestyle: evidence from prospective cross-cultural, cohort, and intervention studies.*  
Circulation. 2002 Feb, 105(7):893-898.
- *Association between trans fatty acid intake and 10-year risk of coronary heart disease in the Zutphen Elderly Study: a prospective population-based study.*  
Lancet 2001, 357:746-51.
- *The relation between blood pressure and mortality due to coronary heart disease among men in different parts of the world.*  
N Engl J Med; 2000, 342; 1-8.

## THE EPIDEMIOLOGY OF CARDIOVASCULAR DISEASES IN EUROPE

*Daan Kromhout, Nutrition and Consumer Safety Division, National Institute of Public Health and the Environment*

Within Europe large differences exist in mortality from coronary heart disease and stroke. These diseases show a clear West-East gradient in both men and women. Mortality rates are five times higher in Eastern compared with Western European countries. In most Western European countries a downward trend in age-adjusted coronary heart disease and stroke mortality is noticed since 1970. During that period an increasing trend is observed in Central and Eastern European countries e.g. Hungary and the Russian Federation. In recent years an increase was also observed in Greece.

In the Seven Countries Study mortality data were collected prospectively in 16 cohorts of originally 12,763 middle-aged men. During 25 years of follow-up about 6,000 men died, 1,500 from coronary heart disease and 800 from stroke. The 25-year coronary heart disease mortality rate was highest in East-Finland and lowest on the island of Crete. There was a six-fold difference between these two populations. For the mortality rate from stroke a three-fold difference was observed between Zrenjanin (Serbia) and the Dutch town of Zutphen (The Netherlands). At the beginning of the Seven Countries Study the coronary heart disease mortality rates were high in Finland and The Netherlands and low in Serbia and Greece. Time trends showed that the curves for the annual increment of coronary heart disease mortality in Finland and the Netherlands tended to flatten out at the end of the follow-up period. The curve for Greece increased at a regular rate at a low level and the curve for Serbia overcrossed all other curves during 25 years. For stroke all curves tended to rise during 25 years.

From a public health point of view information about the burden of cardiovascular diseases in Europe is needed. In spite the decreasing trend in age-adjusted cardiovascular disease mortality in Western European countries an increase in the number of cardiovascular patients is expected because of the ageing of the population. In many Central and Eastern European countries the number of cardiovascular patients will increase because of the increasing trend in these diseases. We therefore conclude that the number of cardiovascular patients in Europe will increase in the next decades. Consequently also the health care cost for these diseases will increase.

In conclusion cardiovascular diseases are and will stay the most important cause of death in Europe during the next decades. Large changes in age-specific cardiovascular mortality rates occurred during the past 30 years with decreasing rates in Western and Northern Europe and increasing rates in Central and Eastern Europe and recently also in Greece.



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# INTRODUCTION

## Components of the Mediterranean diet

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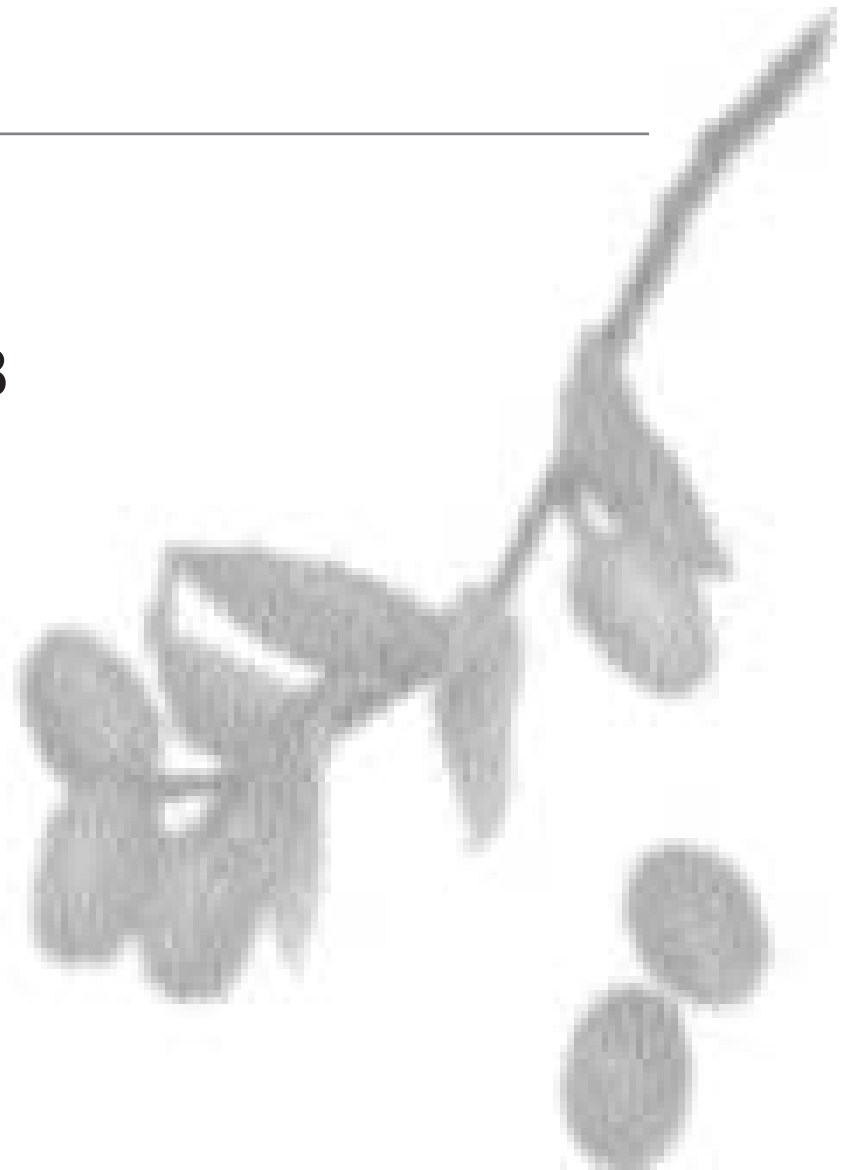
Friday, June 6<sup>th</sup>, 2003

9:00 am

*Minos Conference Room*

*Chairmen :*

A. TRICHOPOULOU  
A. SCHATZKIN





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### BIOGRAPHICAL SKETCH

- 1989-95 : Graduate Chemist to the Department of Chemistry, University of Athens.
- 1996-97 : MSc in Human Nutrition to the King's College, University of London.
- 1998-2002 : PhD entitled: Nutrition in Greece : Data collected in the Greek Household Budget Survey of 1994 and in the Greek component of the EPIC study, Department of Hygiene and Epidemiology, Medical School, University of Athens.

### RECENT PUBLICATIONS

- *Vegetable and fruit consumption in the EPIC cohorts from 10 European countries.*  
IARC Sci Publ. 2002, 156:99-103.
- *A preliminary assessment of the use of household budget survey data for the prediction of individual food consumption.*  
Public Health Nutr. 2001 Oct, 4(5B):1159-65.
- *Fruit and vegetable availability among ten European countries: how does it compare with the 'five-a-day' recommendation? DAFNE I and II projects of the European Commission.*  
Br J Nutr. 2000 Oct, 84(4):549-56.
- *Plasma carotenoid levels in relation to tobacco smoking and demographic factors*  
Int J Vitam Nutr Res. (in press).

## MEDITERRANEAN DIET AT PRESENT

*Androniki Naska, Medical School, University of Athens*

The diet of people in the Mediterranean region has long been recognised among the factors that affect their health in a beneficial way. The Mediterranean diet has been defined on the basis of the dietary pattern found in the region in the late '50s and early '60s, and can be thought of as consisting of nine components:

- (1) high consumption of olive oil and low consumption of lipids of animal origin,
- (2) high consumption of vegetables,
- (3) high consumption of legumes,
- (4) high consumption of cereals (unrefined),
- (5) high consumption of fruit,
- (6) moderate to high consumption of fish,
- (7) moderate consumption of dairy products (yoghurt, cheese),
- (8) low consumption of meat and meat products and
- (9) moderate wine consumption.

Given, however, the rapid changes in the Mediterranean area, the increase of urbanisation and the rise in prosperity, the central question is: Do the Mediterraneans still adhere to their traditional diets that prevailed in the late '50s and early '60s?

There is a lack of comparative studies among Mediterranean countries that address this question. Small dietary surveys, primarily aiming at describing the food choices of population sub-groups, document deviations from the originally described Mediterranean diet, revealing a westernisation of dietary habits. According to current dietary practices in the region, fibre intake is generally low, meat intake has substantially increased and the contribution of olive oil to the daily energy intake has decreased, although the total lipid contribution to the daily energy intake has remained relatively stable.

Comparative between countries data on the availability of foods in nationally representative samples of households can be retrieved from the DAFNE databank. Data for four Mediterranean countries (Greece, Italy, Portugal and Spain) again support the progressive departure of these populations from their traditional dietary patterns.

The DAFNE data agree that, in contrast to the past, people in the region have become important meat consumers. Cheese availability has also increased and the daily availability of vegetables and fruit has decreased. Within country differences in whether people follow their dietary traditions can also be identified. People of lower education or residing in rural areas tend to better adhere to their traditional diet, when respectively compared to their highly educated and urban counterparts.

Dietary data collected in the region agree that important characteristics of the Mediterranean diet are in jeopardy, in several population sections. Hence, actions to protect and promote the traditional Mediterranean diet are needed, even for the South European - Mediterranean populations.



## Nadia SLIMANI (France)

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### BIOGRAPHICAL SKETCH

- 1986-87 : Masters Degree in Cellular Biology and Physiology in University Blaise Pascal, Clermont-Ferrand, France.
- 1987 : Postgraduate specialization in Nutrition in Developing Countries in University of Languedoc-Roussillon, Montpellier, France.
- Since 1990 she has been a Nutritionist in the European Prospective Investigation into Cancer and Nutrition (EPIC) in the Unit of Nutrition and Cancer, IARC-WHO, Lyon, France.
- 2002 : PhD in Nutrition in University of Wageningen, The Netherlands. Thesis entitled : 24-hour diet recalls as reference calibration measurements in EPIC: from a statistical theory to epidemiological application.

### RECENT PUBLICATIONS

- *Food consumption, anthropometrics and physical activity in the EPIC cohorts from 10 European countries - Food consumption data derived from the calibration study* Special issue of Public Health Nutrition, 5 (6B) December 2002.
- *Perspectives of using the EPIC-SOFT programme in the context of pan-European nutritional monitoring surveys: methodological and practical implications.* Eur J Clin Nutr. 2002 May, 56 Suppl 2:S63-74.
- *Standardization of the 24-hour diet recall calibration method used in the European Prospective Investigation into Cancer and Nutrition (EPIC): general concepts and preliminary results.* Eur J Clin Nutr. 2000 Dec, 54(12):900-17.



## DO DIETARY PATTERNS ACTUALLY VARY ACROSS THE 10 WESTERN EUROPEAN POPULATIONS PARTICIPATING TO THE EPIC STUDY?

*Nadia Slimani on behalf of the EPIC group*

*International Agency for Research on Cancer.*

**Introduction:** The European Prospective Investigation into Cancer and Nutrition (EPIC) is a network of prospective studies involving about 500, 000 subjects from 10 Western European countries (France, Italy, Spain, United Kingdom, Germany, The Netherlands, Greece, Sweden, Denmark and Norway). Recent data suggest changes in diet across Europe during the last 30 years, with a trend towards erosion of the differences traditionally existing between European dietary patterns. The lack of standardized methodology to assess individual dietary intakes across Europe make it difficult to estimate the actual nature and magnitude of these differences.

**Objective:** The aim of this study is to describe the dietary patterns observed among the 10 European countries participating in EPIC, using a common standardized dietary method.

**Methods:** A single 24-hour diet recall was collected from a representative sample of study subjects aged 35-74 years (N = 35,955) using a standardized face-to-face computer program (EPIC-SOFT). In France and Norway, only women were recruited. A health conscious group from the UK was considered separately from subjects recruited from the general population. In order to compare 22 main food groups across the 27 centres/geographical regions considered, the centre mean intakes were expressed as the percentage of deviation compared to the overall sex-specific EPIC mean, using multi-dimensional representations.

**Results:** Although wide differences were observed across centres, the countries participating in EPIC are characterized by specific dietary patterns. Overall, Italy and Greece have a dietary pattern characterized by plant foods (except potatoes), and a lower consumption of animal and processed foods compared to the other EPIC countries. France and particularly Spain have more heterogeneous dietary patterns, with a relatively high consumption of both plant foods and animal products. Apart from characteristics specific to vegetarian groups, the UK health-conscious group shares with the UK general population a relatively high consumption of tea, sauces, cakes, soft drinks (women), margarine and butter. In contrast, diet in the Nordic countries, the Netherlands, Germany and the UK general population is relatively high in potatoes and animal, processed and sweetened/refined foods, with proportions varying across countries/centres. In these countries, consumption of vegetables and fruit is similar to, or below, the overall EPIC mean, and is low for legumes and vegetable oils. Overall, dietary patterns were similar for men and women, although there were large gender differences for certain food groups.

**Conclusions:** There are considerable differences in food group consumption and dietary patterns among the EPIC study populations. This large heterogeneity should be an advantage when investigating the relationship between diet and cancer and formulating new etiological hypotheses related to dietary patterns and disease.



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## SESSION 1

# Mediterranean diet and cancers : epidemiology, clinical and mechanisms of actions

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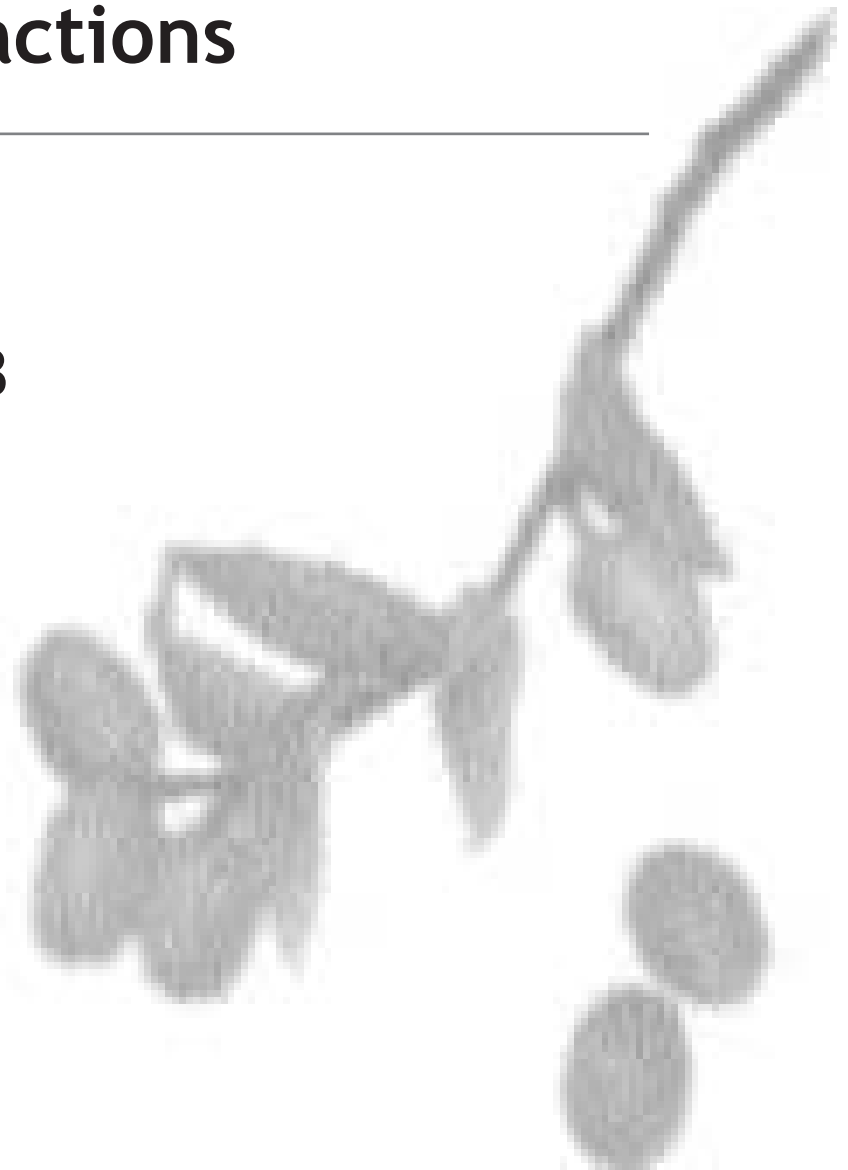
Friday, June 6<sup>th</sup>, 2003

10:20 am

*Minos Conference Room*

*Chairmen :*

A. TRICHOPOULOU  
A. SCHATZKIN





## Elio RIBOLI (IARC-WHO)

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### BIOGRAPHICAL SKETCH

- Dr Riboli has an M.D. degree (1977, Milan), a Master of Public Health (1980, Milan) and a Master of Science in Epidemiology (1982, Harvard, Boston, USA).
- In 1983 he moved to IARC-WHO in Lyon, where he undertook the task of developing new research projects in the area of nutrition, nutritional status and cancer. In 1989 he initiated the European Prospective Investigation into Cancer and Nutrition (EPIC), which eventually included 26 centres in 10 European countries. Questionnaire data on diet and lifestyle have been obtained from about 500,000 study subjects, and blood samples from most of them.
- In 1995 he was appointed Chief of the Unit of Nutrition and Cancer of IARC, whose main object will be follow-up of EPIC over the next decade and research into the role of nutrition, lifestyle, environment, genetics and metabolic and hormonal factors in cancer etiology.

### RECENT PUBLICATIONS

- *Nutrition and Lifestyle: Opportunities for Cancer Prevention.*  
IARC Sci Publ No 156. Lyon: International Agency for Research on Cancer, 2002.
- *Nutritional and lifestyle determinants of DNA oxidative damage: a study in a Mediterranean population.*  
Carcinogenesis 2002, 32; 1483-9.
- *Fruits et légumes, des antidotes au risque de cancer?*  
Concours Medical 2002, 26/27: 1739-45.
- *EPIC: Study populations and data collection.*  
Publ Health Nutr 2002, 5:1113-24.

## CONSUMPTION OF FRUIT AND VEGETABLES AND PREVENTION OF CANCERS OF THE DIGESTIVE TRACT : RESULTS FROM EPIC AND OTHER STUDIES

*Elio Riboli and Teresa Norat, International Agency for Research on Cancer (IARC-WHO)*

**Background:** Epidemiological data generally support the association between high fruit and vegetable intake and reduced risk of cancers of the digestive tract. We report the results from a meta-analysis of published studies (a) and from the European Prospective Investigation into Cancer and Nutrition (EPIC) (b).

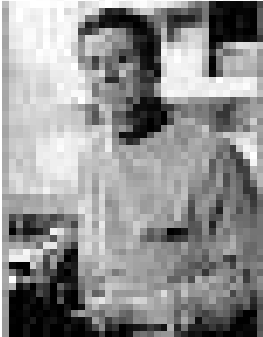
**Materials and Methods:** (a) We summarised the published epidemiological evidence from case-control and cohort studies of cancers of the aerodigestive system (mouth, pharynx larynx, lung, esophagus, stomach and colorectum), breast and bladder, using meta-analytical techniques. Dose-response relationships were estimated using linear-logistic random effect models with consumption of vegetables and fruits in separate models for each cancer site. (b) In addition, we studied the association between cancer incidence and fruit, vegetable and fibre intake in the EPIC study based on 522,000 subjects from 10 European countries.

**Results:** (a) The pooled estimates of the association between vegetables and cancer obtained from cohort studies are suggestive of a protective effect for all the cancer sites investigated: breast, lung, bladder, stomach, colorectum, but the association was statistically significant only for gastric cancer (RR per 100 g/day increase = 0.88; 95% CI: 0.79-0.98). The average estimate for breast cancer suggests no association (RR per 100 g/day increase = 0.99; 95% CI: 0.96-1.01). Case-control studies provide statistically significant pooled odds ratios for cancer of the breast, lung, stomach and colorectum. For cancers of the bladder, mouth and pharynx, larynx and esophagus, case-control studies suggest a protective effect, but the pooled estimates are not statistically significant.

Both cohort and case-control studies are more supportive of the protective effect of fruit than of vegetables for the cancers included in the meta-analysis. The pooled RR from cohort studies is statistically significant for cancers of the lung (RR per 100 g/day increase = 0.86; 95% CI: 0.78-0.95) and, for cancer of the lung, bladder, colorectum, mouth and pharynx, larynx and esophagus, the protective effect in case-control studies was significant only for breast cancer (RR per 100 g/day = 0.92; 95% CI: 0.84-1.01).

(b) The results based on the first 5 years of follow-up of the EPIC subjects are strongly supportive of a protective effect of fibre-rich foods (cereals, fruit and vegetables) against colorectal cancer. Fruits and vegetables are also strongly associated with reduced risk of cancer of the upper aero-digestive tract, but more weakly associated with a reduction in risk for other cancers.

**Conclusions:** Current recommendations promoting high intakes of whole cereals, fruit and vegetables are justified, and they may lead to a significant reduction in cancer risk.



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### BIOGRAPHICAL SKETCH

- Arthur Schatzkin is board certified in internal medicine and preventive medicine/public health.
- Dr. Schatzkin joined the NCI in 1984 as a senior staff fellow in the Cancer Prevention Studies Branch of the Division of Cancer Prevention and Control, and became a senior investigator in 1988.
- He joined the DCEG Nutritional Epidemiology Branch in 1997, and was appointed Branch Chief in 1999.
- Dr. Schatzkin's research focuses on the nutritional etiology and prevention of cancer. He received the NIH Merit Award for his work on the Polyp Prevention Trial. He is the principal investigator for the NIH-AARP Diet and Cancer Study, a National Institute-sponsored prospective cohort study of half a million men and women in the USA.

### RECENT PUBLICATIONS

- *Fruit and vegetable intakes and the risk of colorectal cancer in the Breast Cancer Detection Demonstration Project follow-up cohort.*  
 Am J Clin Nutr. 2002 May, 75(5):936-43.
- *The promise and peril of surrogate end points in cancer research.*  
 Nat Rev Cancer. 2002 Jan, 2(1):19-27.
- *Epidemiological studies of cereals, fruit and vegetables.*  
 IARC Sci Publ. 2002, 156:77.
- *Design and serendipity in establishing a large cohort with wide dietary intake distributions : the National Institutes of Health-American Association of Retired Persons Diet and Health Study.*  
 Am J Epidemiol. 2001 Dec 15, 154(12):1119-25.

## FIBER AND COLORECTAL CANCER PREVENTION

Arthur Schatzkin, M.D., Dr.P.H.

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The idea that unrefined and poorly digested 'roughage' in the diet is good for human health has been popular for many centuries. The specific hypothesis that dietary fiber consumption can protect humans against colorectal cancer was advanced over three decades ago by Burkitt and achieved considerable acceptance in both medical-professional and lay circles. Several plausible mechanisms have been advanced to explain why high fiber intake could lower one's risk of colorectal cancer, including dilution and possibly enhanced excretion of carcinogens through stool bulking; altered gut flora leading to reduced production of carcinogenic bile acids; and production of anti-carcinogenic short chain fatty acids; and modulation of energy metabolism, possibly through an effect on insulin resistance. The scientific foundation for this question is complicated by the complexity of 'fiber', a heterogeneous collection of plant food components characterized primarily by relative indigestibility in the human intestinal tract. Further complications arise from difficulties in measuring the fiber content of foods and constructing accurate nutritional data bases for epidemiologic investigation. Nevertheless, a body of case-control studies seemed to indicate, on balance, a protective association between dietary fiber intake and colorectal cancer. In the last few years, however, several high-profile reports from prospective epidemiologic studies and dietary prevention trials have cast doubt on the fiber-colorectal cancer hypothesis. , , This is not the first time that a cherished notion about disease causation and prevention has been challenged by new scientific evidence. In light of the potential public health importance of this diet and cancer hypothesis, the recently published studies, and the questions raised subsequent to these reports, a reappraisal of the relation between dietary fiber intake and the risk of large bowel cancer is in order. It should be recognized that limitations of even well-designed prospective cohort studies--including narrow intake range in a given population and error in the assessment of fiber intake--could explain null results from observational epidemiology. The polyp trial model also has inferential limitations based on timing factors and the limited spectrum of neoplastic change under investigation. Finally, findings from some recent prospective studies suggest, in spite of some of our best efforts to kill the idea, that the fiber hypothesis remains very much alive.

1. Burkitt DP. *Epidemiology of cancer of the colon and rectum*. Cancer 1971; 28:3-13.
2. Fuchs CS, Giovannucci EL, Colditz GA, Hunter DJ, Stampfer MJ, Rosner B, Speizer FE, Willett WC. *Dietary fiber and the risk of colorectal cancer and adenoma in women*. N Engl J Med 1999; 340:169-176.
3. Schatzkin A, Lanza E, Corle D, Freedman L, Lance P, Marshall J, Iber F, Caan B, Shike M, Weissfeld J, Schoen RE, Burt R, Slattery M, Cooper MR, Kikendall JW, Cahill J, and the PPT Study Group. *Lack of effect of a low-fat, high-fiber, diet on the recurrence of colorectal adenomas*. N Engl J Med 2000; 342:1149-55.
4. Alberts DS, Martinez ME, Roe DJ, Guillen-Rodriguez JM, Marshall JR, van Leeuwen JB, Reid ME, Ritenbaugh C, Vargas PA, Bhattacharyya AB, Earnest DL, Sampliner RE. *Lack of effect of a high-fiber cereal supplement on the recurrence of colorectal adenomas. Phoenix Colon Cancer Prevention Physicians' Network*. N Engl J Med 2000;342:1156-62.



## Stein Emil VOLLSET (Norway)

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 Section for Medical Statistics  
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### BIOGRAPHICAL SKETCH

- Stein Emil Vollset is board certified in Medicine (University of Bergen), Master and Doctor of Public Health (School of Public Health, University of California at Los Angeles (UCLA)), and currently professor of Medical Statistics and assistant director of the Medical Birth Registry.
- Pr. Vollset was visiting professor in 1993-94 in the Department of Biomathematics of UCLA School of Medicine, and visiting scientist in 1998-99 at the International Agency for Research on Cancer, in the Unit of Nutrition and Cancer, in Lyon.
- Pr. Vollset participated in the initiation and in research based on the Hordaland Homocysteine Study since this 18 044 person cohort was established in 1992-93.
- He has been working with the Medical Birth Registry of Norway and The Norwegian Arthroplasty Register for the past decade.

### RECENT PUBLICATIONS

- *Plasma total cysteine, pregnancy complications, and adverse pregnancy outcomes: the Hordaland Homocysteine Study.* Am J Clin Nutr. 2003 Feb, 77(2):467-72.
- *Thermolabile methylenetetrahydrofolate reductase, homocysteine, and cardiovascular disease risk: the European Concerted Action Project.* Am J Clin Nutr. 2003 Jan, 77(1):63-70.
- *Plasma total homocysteine and cardiovascular and noncardiovascular mortality: the Hordaland Homocysteine Study.* Am J Clin Nutr. 2001 Jul, 74(1):130-6.
- *The Hordaland Homocysteine Studies.* Lipids. 2001, 36 Suppl:S33-9.



## FOLATE AND CANCER

*Stein Emil Vollset, MD, DrPH*

*Locus for homocysteine and related vitamins*

*University of Bergen, Norway*

Our knowledge of folate and cancer stem from animal experiments, observational and experimental studies in humans. Here we will review two lines of evidence from observational studies in humans: (1) cohort studies on folate and cancer<sup>1-4</sup>, and (2) case-control studies of cancer and the 677C→T single nucleotide polymorphism (SNP) of the methylenetetrahydrofolate reductase (MTHFR) gene<sup>5</sup>.

In cohort studies the participants were characterized with respect to folate status (blood measurements or intake estimated from information on dietary habits and use of vitamin supplements). The participants were then followed for many years and occurrence of cancer monitored. Most cohort studies of folate and cancer have studied breast cancer or colorectal neoplasia.

In none of six cohort studies a direct and significant association between breast cancer and folate intake or folate measured in blood was observed. In four of five studies, however, where an interaction with alcohol consumption was assessed, there was evidence of an inverse association between folate and breast cancer in women with high intake of alcohol.

We identified 14 reports from cohort studies on colorectal neoplasia and folate or multivitamins with folic acid. The inverse relationship between folate and colorectal cancer or adenomas that was reported from the U.S. Nurses Health and Health Professionals studies was not consistently reproduced in later cohort studies. As with breast cancer there was evidence that risk is particularly elevated when low folate status is combined with moderate to high alcohol consumption. The largest study on dietary folate and colorectal cancer from the Netherlands demonstrated an inverse relationship between folate intake and colon cancer in both men and women, and for rectal cancer in men<sup>3</sup>. In some studies the inverse relationship was only observed in subgroups defined by sex, alcohol consumption or anatomical localization of the tumor. One study found no evidence of an association between folate and colorectal cancer. Both measurement of folate in blood (plasma, serum, full blood or erythrocytes) and estimation of folate intake from dietary questionnaires is problematic and measurement error likely to weaken any true relationship between folate and cancer. Therefore associations between cancer risk and single nucleotide polymorphisms (SNPs) with functional effects on folate metabolism may yield valuable new insight into this area.

Of particular interest is the 677 C→T SNP of the methylenetetrahydrofolate reductase (MTHFR) gene that has been extensively studied in relation to birth defects, cardiovascular disease and cancer, in particular colorectal neoplasia<sup>5</sup>. This gene codes the enzyme responsible for the irreversible conversion of 5,10-methylenetetrahydrofolate to 5-methyltetrahydrofolate. These folate species serve different biologic functions. The 677C→T SNP affects the conversion rate and hence the availability of folate for RNA and DNA synthesis, on one hand, versus the availability of methyl groups for DNA methylation and protein synthesis on the other. We identified 27 case-control studies of cancer occurrence in relation to the MTHFR 677C→T SNP. Seven studies in more than 3,000 patients assessed the relationship between colorectal or colon cancer and this SNP. Overall, the TT genotype had a highly significant and moderately protective effect against colorectal cancer that contrasts with its weak and non-significant association with increased risk for colorectal adenomas or polyps. Strongly increased risk with the TT genotype was observed in three case-control studies of gastric cancer, one study of esophageal cancer, and one study of endometrial carcinoma. No clear patterns of association were observed with breast cancer (three studies), lung cancer (one study), cervical dysplasia (one study), prostate cancer (one study), bladder cancer (one study) or cancers of the oral cavity (one study).

For acute leukemias (three studies) there was a tendency towards decreased risk associated with the TT genotype. There is extensive evidence that the relationship between the 677C→T SNP and cancer is modified by folate status, methionine and alcohol intake and indications that it may differ among subtypes of neoplasias.

In conclusion, the current evidence points towards a role of folate in carcinogenesis and neoplastic development that is complex and interacting with genetic background, diet, and types and subtypes of neoplasia and stages of carcinogenesis.

#### Literature

(Selected references to some recent reviews and cohort studies)

1. Eichholzer M, Luthy J, Moser U, Fowler B. *Folate and the risk of colorectal, breast and cervix cancer: the epidemiological evidence*. *Swiss Med Wkly* 2001;131(37-38):539-49.
2. Ryan BM, Weir DG. *Relevance of folate metabolism in the pathogenesis of colorectal cancer*. *J Lab Clin Med* 2001;138(3):164-76.
3. Konings EJ, Goldbohm RA, Brants HA, Saris WH, van den Brandt PA. *Intake of dietary folate vitamers and risk of colorectal carcinoma: results from The Netherlands Cohort Study*. *Cancer* 2002;95(7):1421-33.
4. Zhang SM, Willett WC, Selhub J, Hunter DJ, Giovannucci EL, Holmes MD, Colditz GA, Hankinson SE. *Plasma folate, vitamin B6, vitamin B12, homocysteine, and risk of breast cancer*. *J Natl Cancer Inst* 2003;95(5):373-80.
5. Ueland PM, Hustad S, Schneede J, Refsum H, Vollset SE. *Biological and clinical implications of the MTHFR C677T polymorphism*. *Trends Pharmacol Sci* 2001;22(4):195-201.





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### BIOGRAPHICAL SKETCH

- Dr. van't Veer received his MSc degree in Human Nutrition in Wageningen in 1982, followed by his MSc in Epidemiology at Harvard School of Public Health (Boston, 1983).
- His scientific career focused on diet and cancer, initially on breast cancer (EURAMIC study) and later shifted to colorectal and hepatocellular cancer.
- He has been employed by the Netherlands Cancer Foundation (1982-1984) and by the Netherlands Organisation for Applied Scientific Research from 1984 to 1992.
- Since 1993 Dr. van't Veer has been employed by Wageningen University and became professor in Nutrition and Epidemiology in 2002.

### RECENT PUBLICATIONS

- *Dietary factors, genetic susceptibility and somatic mutations in colorectal cancer: a prospective study*  
IARC Sci Publ. 2002, 156:503-4.
- *Human studies to substantiate health effects of antioxidants. What is needed?*  
Free Radic Res. 2000 Nov, 33 Suppl:S109-115.
- *Fruits and vegetables in the prevention of cancer and cardiovascular disease.*  
Public Health Nutr. 2000 Mar, 3(1):103-7.
- *Predictors of adipose tissue tocopherol and toenail selenium levels in nine countries: the EURAMIC study. European Multicentre Case-Control Study on Antioxidants, Myocardia Infarction, and Cancer of the Breast.*  
Eur J Clin Nutr. 1996 Sep, 50(9):599-606.

## THE USE OF BIOMARKERS TO VALIDATE REPORTED DIETARY INTAKE.

*Pieter van 't Veer,*

*Division of Human Nutrition, Nutrition and Epidemiology chair, Wageningen University.*

Validity of dietary assessment is one of the cornerstones of inference from epidemiological studies on diet and health. Validity is defined in terms of its objective, i.e. "the method measures what it is intended to measure". Therefore, it necessarily depends on the objectives of the study hypothesis (exposure, outcome, association) and research setting (design, population).

Traditionally, validity of dietary assessment has been assessed by cross-sectional comparisons of methods, e.g., diet histories and food frequency questionnaires (FFQ). Methodology has been improved by (random) replicated assessment using either diet recalls or records; this avoids spurious associations because of memory-based correlation of reporting errors, but correlated errors originating from food tables remain.

Further improvement was obtained by extending this approach to the triad design in which biomarkers are incorporated as they have measurement errors that are truly independent of dietary intake. The triad design has been used for validating a number of dietary exposures, e.g., protein intake by urinary nitrogen, alcohol intake by HDL, fatty acids patterns by fat aspirates and beta-carotene intake by plasma levels. This approach requires nutrient content from food tables, as well as related biomarkers of nutrients, their metabolites or their effects. However, suitable biomarkers are (at least partially) specific to certain dietary components; this limits assessment of validity to areas of consolidated knowledge ("gold standard").

Unfortunately, evidence of validity for one or two specific dietary constituents is often taken as evidence of validity for the method as a whole, i.e. for dietary and nutritional dimensions extraneous to the validated factors. This incorrect generalisation can lead to spurious associations between diet and health and is of serious concern to the credibility of nutritional epidemiology. To validate dietary patterns as a whole, the correlated and independent aspects of dietary habits need to be determined in the first place; subsequently, biomarkers need be selected that specifically represent these factors.

However, for many nutrients or food components of today's scientific interest no biomarkers are available yet or their application is limited to laboratory settings. Examples are isoflavones from soy products, glucosinolates and their cognate isothiocyanates from brassica vegetables, limonoids from citrus fruits, or the lignans and their metabolites enterodiol and enterolacton. To substantiate the validity of dietary assessment in large-scale epidemiological studies, development of food tables needs to be accompanied by controlled human intervention studies addressing the pharmaco-kinetics and dose-response relationships of these dietary components.

Apart from validation of dietary assessment, biomarkers also have their own intrinsic value. Of course, markers that are correlates of intake but not part of the causal chain to disease may suffice for validation purposes. However, biomarkers that are part of the causal chain can even further strengthen the intake-based evidence. This is because they bridge the gap between dietary intake and biological mechanisms as suggested from clinical studies, animal and in vitro data. In addition, the exposure-disease relationship may be stronger since such markers may be more specific to exposure, especially if they have a limited number of many other determinants. These intermediate markers may strengthen the evidence because of their innate relationship between both exposure and risk of disease.



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## SESSION 2

# Mediterranean diet and cardiovascular diseases

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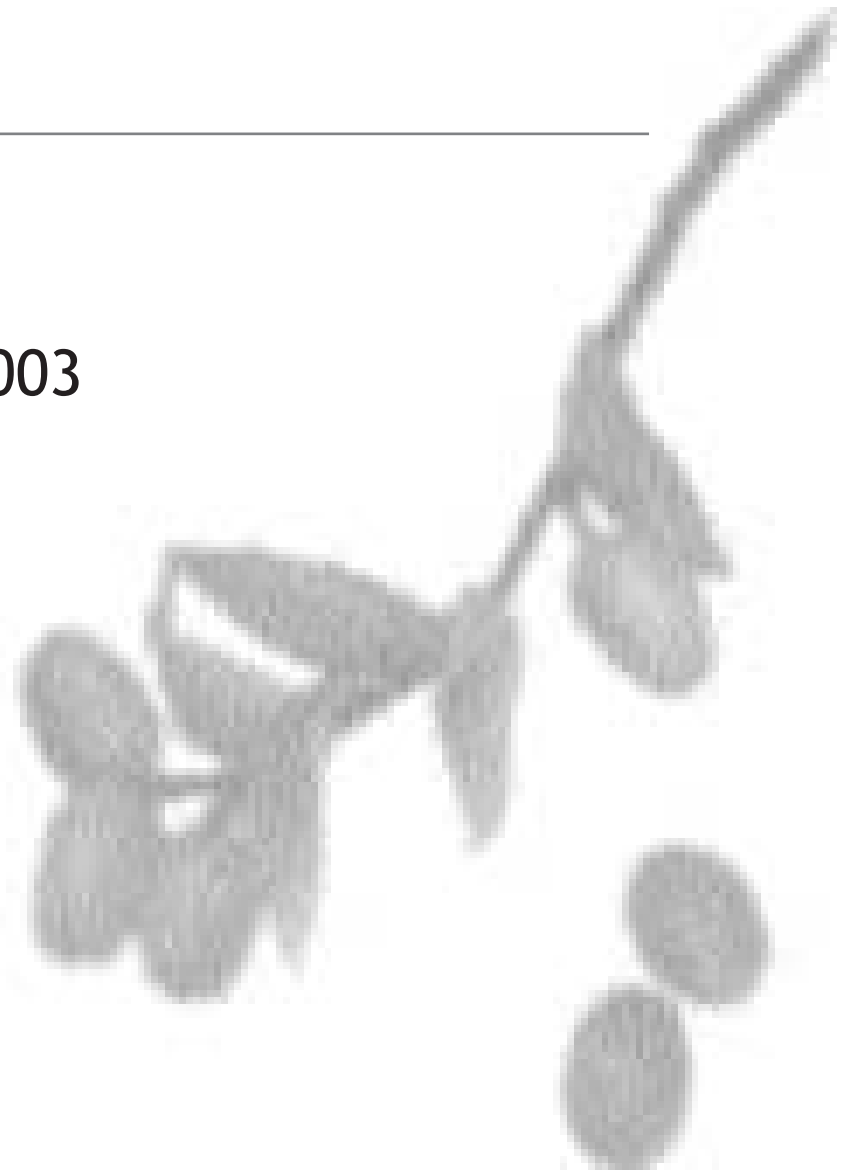
Saturday, June 7<sup>th</sup>, 2003

9:00 am

*Minos Conference Room*

*Chairmen :*

S. RENAUD  
D. KROMHOUT







## THE MEDITERRANEAN DIET AND CORONARY HEART DISEASE

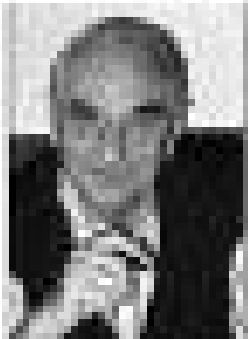
*Daan Kromhout*

*Nutrition and Consumer Safety Division, National Institute of Public Health and the Environment*

The Mediterranean diet is a plant-food based diet with olive oil as the principal source of fat. Many variants are present. The Italian Mediterranean diet is moderate in olive oil and high in cereals. The olive oil content of the Greek, Spanish and Dalmatian Mediterranean diet is much higher than that of the Italian one. The Greek Mediterranean diet is also characterised by a high intake of fruit and the Spanish and Dalmatian diet by a high intake of fish.

Information about the composition of the traditional Mediterranean diet in coastal Italy, Dalmatia and Greece was obtained in the Seven Countries Study in the 1960's. Cohorts of originally middle-aged men were examined and followed for 25 years. The lowest mortality rate for coronary heart disease was observed for the Cretan cohort. The mortality rates were twice as high in the other Mediterranean cohorts of the Seven Countries Study. The mortality rates of the Mediterranean cohorts were much lower than those of the Northern European cohorts.

These results show that "the" Mediterranean diet does not exist. Different Mediterranean diets are associated with different mortality rates from coronary heart disease and the lowest rate was observed in Crete. The traditional Cretan Mediterranean diet is rich in plant foods, has the highest content of olive oil and fruit and wine is consumed in moderate amounts. This type of diet can be a prototype for diets prescribed for prevention of coronary heart disease.



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#### BIOGRAPHICAL SKETCH

- Serge Renaud is board certified in veterinary medicine (VMD), in experimental Medecine and Surgery (PhD) and in Hematology (PhD).
- From 1973 to 1995 he was director of the INSERM Research Unit 63.
- His major research interests are : Nutrition, cardiovascular diseases, lipids, antioxidants, alcohol ("French Paradox"), mediterranean diet, epidemiology and hematology. He was the principal investigator in The Lyon Diet Heart Study.
- In 1983 he received an award of the "Fondation Française de Nutrition" and in 1997 the French Nestle award of Nutrition.

#### RECENT PUBLICATIONS

- *Dietary fats and coronary heart disease pathogenesis.*  
Curr Atheroscler Rep. 2002 Nov, 4(6):419-24.
- *Fish, meat, and risk of dementia: cohort study.*  
BMJ. 2002 Oct, 26;325(7370):932-3.
- *Coronary heart disease: dietary links and pathogenesis.*  
Public Health Nutr. 2001 Apr, 4(2B):459-74.
- *Diet and stroke.*  
J Nutr Health Aging. 2001, 5(3):167-72.

## CRETAN DIET TO PREVENT CLINICAL MANIFESTATION OF CORONARY HEART DISEASE

*Serge Renaud*

*INSERM*

Results from the Seven Country Study have suggested that the Mediterranean diet was effectively preventing from coronary heart disease (CHD). Nevertheless, among the Mediterranean cohorts there was only one associated with a striking protective effect of both CHD and mortality from all causes. However the outstanding life expectancy of the Crete cohort could be due to the exceptional climate, the absence of stress and pollution, the after lunch siesta or other factors yet to be discovered rather than the poor people diet they used.

To elucidate the possible factors and mechanisms involved in that protection, an intervention trial had to be set up. We performed such a study at the Cardiovascular Hospital in Lyon, in a randomized trial in 600 patients after a first myocardial infarction. For that purpose, an adaptation for France of the Cretan Diet was given to 300 patients compared to the classical prudent diet in also 300 patients. After 27 months follow up (1, 2) new cardiovascular events and death were lowered by 76 % with the Cretan diet and mortality from all-causes was also 70 % lower. An additional surprising result was the Cretan Diet protection developing rapidly within 2 months of diet. The protective dietary habits consisted of a higher intake of cereals, vegetables and fruit, replacing butter and cream by a rapeseed oil margarine. Of course, margarine was not used by the Cretan population who consumed rather snails, nuts and wild-green rich in alpha-linolenic acid as is the rapeseed oil margarine. Olive oil used for cooking does not contain enough alpha-linolenic acid for the total prevention of CHD clinical manifestations.

The spectacular results of the Lyon study have now been confirmed recently by an intervention trial in India and Israel (3) on 1000 patients using, instead of rapeseed oil and margarine, mustard oil which has a fatty acid composition similar to rapeseed oil. In the Indian study sudden death was reduced by 67 % and total death by 59 %. Even more recently (4) in Costa Rica and Boston, a case control study on 482 patients with non fatal myocardial infarction compared to 482 control subjects, had a highly significant lower level of alpha-linolenic acid in their adipose tissue independently of other risk factors ( $P < 0.0001$  for trend).

This type of dietary habits including rapeseed oil and margarine has been introduced in Finland, in the last 30 years (5). During that period, mortality from CHD has decreased by up to 75 % (in men 35 to 44 years), but also mortality from stroke and cancer by more than 60%.

Thus dietary habits easy to adopt, still compatible with gourmet diet, cheap without side effects, protect from CHD clinical manifestation within days. A key role in that protective effect seems to be due to alpha-linolenic acid, the precursor of the n-3 essential fatty acids as we reviewed recently in a paper suggested by the American Heart Association (6).

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#### BIOGRAPHICAL SKETCH

- Dr Lanzmann realized medical Medicine study and Nutrition study in Nancy (1974-1988 France).
- She managed a Nutrition research group in agrobusiness for 12 years (1989-2000).
- Now Dr. Lanzmann is an hospital practitioner in Public Health and in Geriatrics in Paris. She also works in nutrition in S. Renaud research group (INSERM 330, Bordeaux) on the alpha-linolenic interests in cardiovascular prevention.
- She is co-creator and co-editor of the Journal of Nutrition Health and Aging.

#### RECENT PUBLICATIONS

- *Primary prevention of cardiovascular diseases by alpha-linolenic acid.*  
 Am J Clin Nutr. 2002 Dec, 76(6):1456; author reply 1456-7.
- *Dietary fats and coronary heart disease pathogenesis.*  
 Curr Atheroscler Rep. 2002 Nov, 4(6):419-24.
- *Alpha-linolenic acid and cardiovascular diseases.*  
 J Nutr Health Aging. 2001, 5(3):179-83.
- *Coronary heart disease: dietary links and pathogenesis.*  
 Public Health Nutr. 2001 Apr, 4(2B):459-74.

## VENTRICULAR, ATRIAL FIBRILLATION AND CRETAN DIET

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The Cretan subjects of the seven country cohort consumed the traditional Cretan diet. Cardiac death was a rare event, 2 to 12 times lower than in the other Mediterranean countries. Cardiac death in patients with ischemic heart disease is usually due to ventricular fibrillation, a sudden loss of ventricular efficiency caused by a ventricular arrhythmia (ventricular fibrillation or ventricular tachycardia). This sudden death can even occur in persons not knowing they have coronary problems. Severe arrhythmia is one of the three phenomena constituting the pathogeny of coronary disease, with atherosclerosis and thrombosis, all influenced by diet (1).

The initial hypothesis of Serge Renaud was that the low mortality rate of the Cretan cohort was related to a high plasma level of alpha-linolenic acid (ALA) the precursor of the omega 3 fatty acid family. In the duplication of the Cretan diet (2) on 600 coronary patients in Lyon, butter and cream were replaced by a rapeseed oil margarine rich in ALA. Oil was primarily olive oil and fruit consumption increased by 20 %. Sudden death was not anymore observed as compared to 10 in the control group with the prudent diet. Singh et al (3) in India confirmed recently these results, using mustard seed oil, that has similar composition to rapeseed oil. In the experiment group, only were observed 6 sudden cardiac death, versus 16 in the control group. In addition, 30 other non-fatal ventricular arrhythmia (ventricular ectopics 8/min) were observed in the controls, but only 8 in the experimental group. Most of the 1000 subjects of the Singh study were vegetarians, not eating fish, but increased their fruit and vegetable consumption. Of additional interest is that without changing serum cholesterol, these two trials observed larger preventive effects on coronary heart disease and all cause mortality than the earlier trials with a marked cholesterol lowering. Longer chain omega 3 fatty acids from fish and fish oil may prevent to some extent cardiac death (Dart and Gissy trials), but not non fatal myocardial infarction.

Animal studies have shown that rapeseed oil was the only oil reducing ventricular fibrillation, mortality and arrhythmia score compared to olive, sunflower and soybean oils (4). Additional studies in rats have observed that ALA may be more efficient to prevent ventricular fibrillation than EPA and DHA (long chain omega 3 fatty acid, present in fish). In vitro, on neonatal rat myocytes in cultures, addition of omega 3 fatty acids both ALA and EPA, DHA, completely inhibited the calcium-induced arrhythmia. The mechanism of the antiarrhythmic effects of omega 3 FA, in normal and Ca<sup>2+</sup> overloaded cells, appears to be primarily by reducing the Ca<sup>2+</sup> entry (5).

Another type of fibrillation is the atrial fibrillation, less severe than the ventricular fibrillation. It is induced by the same type of electrical phenomenon through the channel structure of the myocyte membranes. It involves the auricle instead of the ventricle and occurs in more than 6 % of subjects older than 65 years (6). It is associated with therapeutic complications and pathological consequences such as stroke.

An important problem is that frequent recurrences (50 %) occur whatever is the medical treatment. Intervention trials with either ALA or fish oil, have been started recently, to evaluate whether omega 3 fatty acids may prevent the recurrences of atrial fibrillation after electric shock. If it is the case, this kind of result will represent not only an important public health achievement but also a model to easily demonstrate that a daily consumption of few grams of ALA or fish oil is a key factor in a healthy diet.

This is what has been shown by the Cretan population. Their ancestral diet, rich in ALA (wild greens, vegetables, snails as well as egg, meat) seems to be responsible for the greatest life expectancy of the western world. Unfortunately, all that protection might be rapidly lost, in Crete, if the recent

changes in the diet, as observed by A. Kafatos, are not immediately recognized and reversed. For the sake of the Cretan population but also for this of the Western world in general, it is not acceptable that the exceptional knowledge in nutrition of the Minoan civilization, still present in Crete in the 20th Century, may be rapidly lost, at the beginning of our present century.

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- 6 Ryder KM, Benjamin EJ. *Epidemiology and significance of atrial fibrillation.* Am J Cardiol 1999 ;84(9A) : 131-8R.







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#### BIOGRAPHICAL SKETCH

- Pr. Saracci has an MD and a PhD in medical statistics.
- His early clinical research years were in clinical trials and methodological evaluation of laboratory tests. Subsequently he developed research on the environmental epidemiology of cancer for more than 25 years at the International Agency for Research on Cancer.
- He is currently responsible for the expansion of cancer studies to cardiovascular diseases and is the principal investigator of the EPIC-Heart project, a prospective cohort study (500,000 subjects) of myocardial infarction in 10 European countries.
- Pr. Saracci is also actively involved in methodological issues, in particular methods for improving exposure assessment in epidemiology, and in interactions between aetiological agents, as well as in ethical issues in epidemiology.

#### RECENT PUBLICATIONS

- *The dietary prevention of ischaemic heart disease.*  
IARC Sci Publ. 2002, 156:531-3
- *European Prospective Investigation into Cancer and Nutrition (EPIC): study populations and data collection.*  
Public Health Nutr 2002, 5:1113-24.
- *European Prospective Investigation into Cancer and Nutrition (EPIC) calibration study: rationale, design and population characteristics.*  
Public Health Nutr 2002, 5:1125-45.
- *Cardiovascular diseases: causes, surveillance and prevention.*  
Int J Epidemiol 2001, 30 (Suppl 1): S1-S4.

## FRUITS AND VEGETABLES AND FATAL MYOCARDIAL INFARCTION

*Rodolfo Saracci, on behalf of the EPIC-Heart group*

*International Agency for Research on Cancer, Lyon, France*

### Introduction

The beneficial health effects of dietary fruits and vegetables (FV) are clearly demonstrated by the dramatic consequences of a diet deficient in these foods : scurvy , whose clinical manifestations are essentially due to lack of ascorbic acid but in part to other deficits (iron, folate) was a high fatality conditions plaguing persons -typically crew of long travel sailing vessels -completely deprived of fresh fruits and vegetables. The possible effects of less drastic deficits have attracted attention more recently and a substantial amount of epidemiological evidence is today available on the relationship between fruits and vegetables intake and chronic diseases, in particular cancers at various sites and cardiovascular diseases. Coronary heart disease (CHD), the main contributor to cardiovascular disease mortality, has been investigated through case-control and prospective studies [1,2] relating its occurrence to consumption of fruits and vegetables. Overall these studies provide irregular results : however the negative associations found in the larger prospective studies, better controlled for confounding factors, speak in favour of a likely protective effect. In this respect it is pertinent to mention that some evidence is available from randomized trials that a diet rich in fruits and can reduce both systolic and diastolic blood pressure for periods of months. Given this limited evidence for a protective effect it is of interest to investigate the relationship between fruits and vegetables consumption and coronary heart disease within large prospective studies based on different populations like EPIC, whose component EPIC-Heart is specifically devoted to cardiovascular diseases.

### Methods

The European Prospective Investigation into Cancer and Nutrition (EPIC) is an ongoing prospective cohort in 23 centres located in 11 European countries and is the parent study of the EPIC-HEART project : France, Germany (Heidelberg, Postdam), Greece, Italy ( Florence, Turin, Ragusa, Varese), The Netherlands (Bilthoven, Utrecht), Spain (Granada, Murcia, Navarra, San Sebastian), UK (Cambridge, Oxford), Sweden (Malmo, Umea), Denmark (Aarhus, Copenhagen) and Norway. The study includes extensive dietary and lifestyle questionnaires, anthropometry measurements and blood collection [3]. The follow-up was done using mortality registries at the regional or national level in most centres. A combination of methods including health insurance records and active follow-up through study subjects and their next-of-kin was used in France, Germany and Greece. Cases are subjects with underlying cause of death (or only provided cause of death) in the death certificate as either ICD-9 codes 410-414 or ICD-10 codes I20-I25.

We used Cox proportional hazard regression with age as the underlying time metric. The analyses were stratified by centre to control for differences in follow-up procedures, questionnaire design, and other centre effects and adjusted by sex and energy, and main risk factors as smoking, hypertension, physical activity, alcohol intake and antecedents of diabetes and hyperlipidemia at baseline. The analyses were performed with the variables in both categorical and log-transformed continuous scale.

### Results

457 311 participants without previous heart attack at baseline (141 233 men and 316 078 women) mostly aged 35-70 years were followed for 4,8 years on average since 1992. 844 subjects, 592 men and 252 women, died for fatal myocardial infarction. The percentage of ascertainment of cause of death was 90%. Body mass index, smoking, hypertension and antecedents of hyperlipidemia significantly increased the risk of fatal myocardial infarction and job physical activity, alcohol intake and being a woman decreased the risk. Fruits and vegetables as a whole were not associated with CHD : the hazard ratios (HR) for both sexes combined (using sex-specific quintiles) did not show

a decreasing trend with increase consumption of FV (P for trend 0.80). Hazard ratios for total fruits showed an irregular trend (HR 1;0.91;0.74;0.88;0.80 for the five fifths of the distribution of FV consumption) with a P for trend of 0.10, while no trend was present for citrus fruits. HR for total vegetables showed no trend, while a rather consistent trend appeared for leafy vegetables with values of 1;0.85;0.80;0.83;0.66 for the five fifths of the distribution and a P for trend of 0.01 : on a continuous scale this corresponds to an HR of 0.99 for an increase of 10 g of consumption.

### Conclusion

Except for leafy vegetables no association appears in this set of data between consumption of fruits and/or vegetables and CHD mortality. Further exploration is in progress on an enlarged number of cases (deaths) and more detailed sub-groups of FV.

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3. Riboli E, Hunt KJ, Slimani N, et al. *European Prospective Investigation into Cancer and Nutrition (EPIC): study populations and data collection*. Public Health Nutr. 2002; 5(6B):1113-24.





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#### BIOGRAPHICAL SKETCH

- 1983-1988 : Research in Biostatistics in the National Institute of Sport Medicine, Havana, Cuba.
- 1988-1991 : Research in Epidemiology, Diabetes Epidemiology Unit, National Institute of Endocrinology, Havana, Cuba.
- 1991-1998 : Chief of the Clinic Research Unit, National Institute of Cancerology and Radiology, Havana, Cuba.
- 1998-now : Research in Epidemiology in the Nutrition Unit, IARC, Lyon, France.

#### RECENT PUBLICATIONS

- *Dairy products and colorectal cancer. A review of possible mechanisms and epidemiological evidence.*  
 Eur J Clin Nutr. 2003 Jan, 57(1):1-17.
- *Meat consumption and colorectal cancer risk: an estimate of attributable and preventable fractions.*  
 IARC Sci Publ. 2002, 156:223-5.
- *Fruit and vegetable consumption and risk of cancer of the digestive tract: meta-analysis of published case-control and cohort studies.*  
 IARC Sci Publ. 2002, 156:123-5.
- *Meat consumption and colorectal cancer risk: dose-response meta-analysis of epidemiological studies.*  
 Int J Cancer. 2002 Mar 10, 98(2):241-56.

## MEAT AND FISH AND FATAL MYOCARDIAL INFARCTION

*Teresa Norat, on behalf of EPIC, Hormones and Cancer Group,  
International Agency for Research on Cancer, Lyon, France*

### Introduction

Preventing coronary heart disease (CHD) mortality and morbidity is a leading public health priority. The preventive approach to CHD depends on the modification of the main recognised determinants of the disease, namely tobacco smoking and physical inactivity, but also hypertension, high blood cholesterol, obesity and diabetes, which are substantially influenced by dietary factors. The classic diet-heart hypothesis postulated a primary role of dietary saturated fat and cholesterol in the cause of CHD in humans (1) and dominated most epidemiological and clinical investigations of diet and CHD. More recent studies have investigated the relationship between consumption of specific foods or overall dietary patterns and risk of CHD. Several prospective studies have reported a beneficial effect of fruits and vegetables and an inverse association between nut consumption and risk of CHD (2). Replacement of red meat with chicken and fish has been associated with reduced risk of CHD (3). In the present study we examined the relationship between high intake of meat and fish, and the risk of fatal myocardial infarction, as an expression of CHD, in a prospective cohort study of European men and women with very diverse dietary habits (EPIC-HEART project).

### Methods

The European Prospective Investigation into Cancer and Nutrition (EPIC) is an ongoing prospective cohort study in 23 centres located in 11 European countries and is the parent study of the EPIC-HEART project: France, Germany (Heidelberg, Postdam), Greece, Italy (Florence, Turin, Ragusa, Varese), The Netherlands (Bilthoven, Utrecht), Spain (Granada, Murcia, Navarra, San Sebastian), UK (Cambridge, Oxford), Sweden (Malmo, Umeå), Denmark (Aarhus, Copenhagen) and Norway. The study includes extensive dietary and lifestyle questionnaires, anthropometry measurements and blood collection (4). The follow-up was done using mortality registries at the regional or national level in most centres. A combination of methods including health insurance records and active follow-up through study subjects and their next-of-kin was used in France, Germany and Greece. Cases are subjects with underlying cause of death (or only provided cause of death) in the death certificate as either ICD-9 codes 410-414 or ICD-10 codes I20-I25.

We used Cox proportional hazard regression with age as the underlying time metric. The analyses were stratified by centre to control for differences in follow-up procedures, questionnaire design, and other centre effects and adjusted by sex and energy, and main risk factors such as smoking, hypertension, physical activity, alcohol intake and antecedents of diabetes and hyperlipidemia at baseline. The analyses were performed with the variables in both categorical and log-transformed continuous scale.

### Results

A number of 457 311 participants without previous heart attack at baseline (141 233 men and 316 078 women) mostly aged 35-70 years were followed for 4.8 years on average since 1992. 844 subjects, 592 men and 252 women, died of fatal myocardial infarction. The percentage of ascertainment of cause of death was 90%. Body mass index, smoking, hypertension and antecedents of hyperlipidemia significantly increased the risk of fatal myocardial infarction and job physical activity, alcohol intake and being a woman decreased the risk.

Total red meat intake (fresh plus processed meat) was positively associated to risk of death for myocardial infarction ( $p$  linear trend = 0.0120). The hazard ratio associated to intakes between 61 to 90 g/day of fresh and processed red meat intake compared to less than 30 g/day was 1.43 (95% CI = 1.06-1.91) and for more than 90g/day was 1.37 (95% CI = 1.00-1.89). The risk increase was explained by processed meat ( $p$ -linear trend = 0.0037) with hazard ratio of 1.40 (95% CI = 0.98-2.00) for intakes over 80 g/day compared to less than 10 g/day, while for fresh red meat no association was observed.

The data were suggestive of a protective effect of high intake of white meat (fish and poultry), but it was not statistically significant ( $p$ - linear trend = 0.0833). The hazard ratio for intakes over 80 g/day compared to less than 10 g/day were 0.9 (95% CI = 0.66-1.24). Fish or poultry were not associated to risk of fatal myocardial infarction in separate analyses. The statistical significance for total red meat persisted when including white meat and red meat simultaneously as continuous variables.

### Conclusions

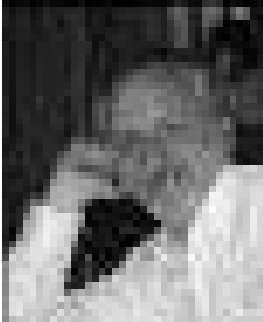
In this cohort of middle aged European men and women, high red meat intake, and in particular processed red meat, is associated with an increased risk of fatal myocardial infarction in multivariate models including main risk factors. High white meat intake was not associated to a risk increase of fatal myocardial infarction. The protective effect of fish intake, previously reported in other prospective studies was not corroborated in this study.

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**BIOGRAPHICAL SKETCH**

- Salvatore Panico is board certified in Medicine (Naples, 1975), in Nephrology (Naples, 1978), Master of Science Epidemiology University of London (1980) and in Cardiology (Naples, 1983).
- Dr. Panico was consultant in the Department of Epidemiology to the National Cancer Institute in Milano in 1986-87.
- He was director of the National Research Council Unit "CVD in Mediterranean women" between 1990-1996.
- Since 1999 Dr. Panico has been coordinator to the Ministry of Health Research Group "CVD risk in Italian women - Progetto CUORE" and Director of the Clinical Epidemiology Lab to the Department of Clinical and Experimental Medicine (Naples Medical School "Federico II").

**RECENT PUBLICATIONS**

- *Radical-trapping activity, blood pressure, and carotid enlargement in women.*  
Hypertension. 2003 Feb, 41(2):289-96.
- *Physical activity in the EPIC cohort in Italy.*  
IARC Sci Publ. 2002, 156:267-9.
- *Dietary and circulating antioxidant vitamins in relation to carotid plaques in middle-aged women*  
Am J Clin Nutr. 2002 Sep, 76(3):582-7.
- *Cardiovascular diseases: causes, surveillance and prevention.*  
Int J Epidemiol. 2001 Oct, 30 Suppl 1:S1-4.

## MEDITERRANEAN DIETARY PATTERN AND CARDIOVASCULAR DISEASE IN ITALY.

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The contribution of data deriving from Italian population samples to the knowledge of the relationship between Mediterranean diet and cardiovascular diseases started at the end of the World War II when Ancel Keys and Paul D. White - during their stay with the American troops in Europe - were impressed by the relatively low frequency of myocardial infarction patients in the hospitals of Napoli, compared with the frequency they had seen in the Boston hospitals. The Italian section of the Seven Countries Study, the pillar investigation of the Diet-Heart hypothesis, was developed in the early sixties in two communities of the Central area of the country, Montegiorgio and Crevalcore, whose populations contributed to the dietary habits large variability of the study, which allowed the sound evidence of the protective effects of the Mediterranean diet. At the end of the seventies the results of the Italian Nine Communities Study conducted in nine random samples of the Italian population, from the North to the South, described the association between the consumption of low-atherogenic food-items and of olive oil with a favourable metabolic and vascular profile including serum cholesterol, triglyceride, glucose and blood pressure levels. In the last two decades many experimental studies conducted mostly in the Mediterranean part of Italy (Centre and South) have contributed to the understanding of the role of some dietary components of the Mediterranean diet to the improvement of the cardiovascular risk profile. Finally, in this last year the first cardiovascular disease incidence follow-up of the EPIC-Italy collaboration has been completed for the female cohorts. About 32,000 adult women, for a total of almost 134 636 person-years have been analysed for their cardiovascular risk according to their dietary lifestyle. The results indicate that Italian women eating with the highest adherence to the Mediterranean diet (measured with an ad hoc dietary score) have less than half of the risk of ischemic heart disease of those with the lowest adherence. Along all the last five decades, the Italian within-population data have been consistently supporting the protective cardiovascular effect of the Mediterranean dietary style.



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#### BIOGRAPHICAL SKETCH

- Mariette Gerber has French MD and Sc.D degrees and an US PhD in Immunology and Tumor Biology. She is currently Head of a Research group on "risk factors of cancers".
- Dr. Gerber realized analysis of diet in several sub regions of Southern France and analysis on determinants of obesity and alcohol consumption in Southern France.
- She also coordinates epidemiological study on the interaction between environmental factors (including nutrition) and gene polymorphisms and on specific effect of fatty acids in breast cancer.
- One of her present research activities concerns intervention trial with Mediterranean diet on subjects at risk for cardio-vascular diseases.

#### RECENT PUBLICATIONS

- *Subregional variations of dietary consumption and incidences of cancers in southern France.*  
IARC Sci Publ. 2002, 156:127-9.
- *Oxidant-antioxidant status in relation to survival among breast cancer patients.*  
Int J Cancer. 2002 Feb 10, 97(5):574-9.
- *The comprehensive approach to diet: a critical review.*  
J Nutr. 2001 Nov, 131(11 Suppl):3051S-5S.
- *Diet profiles in a population sample from Mediterranean Southern France.*  
Public Health Nutr. 2001 Apr, 4(2):173-82.

## THE MED-RIVAGE INTERVENTION STUDY ON MEDITERRANEAN DIET AND RISKS FOR CORONARY HEART DISEASE

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*<sup>2</sup>Unité 476-Human nutrition and lipids at INSERM (National Institute of Health and Medical Research), Faculty of medicine*

The Lyon Diet Heart Study was the first trial based on a Mediterranean-type dietary intervention and showed a beneficial effect on the survival rate after myocardial infarction. Because it has been shown that French Mediterranean populations are giving up their original dietary habits (Scali et al, 2001), we undertook an intervention study with a Mediterranean diet-based nutritional approach. The first goal of the study was primary prevention of cardio-vascular diseases by evaluating the effect of Mediterranean diet on arteriosclerosis risk factors in subjects presenting at least one risk factor. A second objective of the study was to implement extensive biological investigation in relation to the dietary intervention, with a special interest on fasting and post-prandial examinations of lipid parameters and lipoproteins as well as some genetic polymorphisms influencing lipoprotein metabolism and homeostasis.

### Subjects and methods

Volunteers visiting the Centre for Detection and Prevention of Arteriosclerosis (CDPA) at La Timone University Hospital in Marseille were identified as potential participants whether they presented at least one risk factor (e.g. obesity, untreated cholesterolemia, etc..). Subjects treated by hypolipemic and hypoglycaemic drugs were excluded. The final sample was made of 37 men and 51 women (n=88). The follow up was planned over 3 and 12 months.

The participants received a booklet with general principles of Mediterranean diet (a variety of fruit, legumes and vegetables to eat, raw or cooked, fresh or dried ; whole rather than refined cereals ; fish rather than meat ; yoghurt or cottage cheese rather than hard cheese) and to facilitate compliance, a set of 3 menus for each meal of the 14 days of 2 weeks in winter/spring and 2 weeks in summer/fall with the corresponding recipes. These menus were calculated to obtain over a week a daily mean carbohydrate, protein and lipid accounting for 50%, 12 to 15% and 35 to 38% of the total energy intake, respectively. Saturated fatty acids (SFA) should represent 8 to 10%, monounsaturated FA (MUFA) 18 to 20% , and polyunsaturated FA (PUFA) 8 to 10% of energy with a MUFA/SFA ratio above 1. The recommended fibre intake was above 25g/d and carotenoids intake around 7mg/d. A validated set of photographs (Bonifacj et al, 1997) indicated the portions appropriate to the recommended caloric intake of the participant, based on the body mass index (BMI) and the physical activity of the participant. Fruit and vegetables could be consumed ad libitum. Nutritional intake was assessed at baseline 3, 6, and 9 months using a 3-day recall questionnaire. At the same time, nutritional markers, such as plasma fatty acids, carotenoids, and phenolic compounds were measured.

At the same time, another group of subjects was made of 32 men and 49 women (n=81) which were recommended to have an habitual prudent-type low saturated fat, low cholesterol diet. A clinical examination and biological evaluation of risk factors was performed at baseline, and 3 and 12 months after. 15 fasting blood biochemical measurements were done (cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride, triglyceride-rich lipoproteins, apoproteins, glucose, insulin, haemostasis parameters) while 7 determinations were repeated 2h30 and 5h after a standardized test meal.

At baseline, 9 gene polymorphisms were analysed on DNA from blood nucleated cells. The protocol was approved by the ethic committee (CCPPRB Marseille 1) and written informed consent to participate was obtained from all participants.

Statistical analysis was performed with SPSS package. When variables distribution was not normal, log transformation was used. Spearman correlations were used to relate the nutritional biomarkers to the declared intake, and multivariate analysis, when adjustment was required. A t-test was used to compare baseline variables with the corresponding 3-month variables.

### Results : dietary data and nutritional markers

At baseline, the nutritional intake of the subjects departed from the traditional Mediterranean diet: The proportion of energy related to macronutrients was unbalanced, with too much protein ( $18.4\% \pm 3.8$ ) and lipid ( $39.2 \pm 6.2$ ) at the expense of carbohydrates ( $42.4 \pm 6.2$ ). SFA provided  $14.5 \pm 3.8$  of the total energy. Total fibre intake was  $19.7 \pm 7.0$ , and among micronutrients vitamin E, folates and carotene intake was just normal, whereas vitamin C was optimal. Significant correlations were observed between carotenoid and folate intake and plasma carotenoids and folic acid, respectively.

At 3 months in the Mediterranean-diet group, the proportion of energy related to macronutrients was improved with a significant increase in carbohydrates intake ( $45.9\% \pm 5.1$ ) and decrease in lipid ( $34.6\% \pm 6.9$ ) especially SFA ( $10.0\% \pm 2.6$ ), MUFA increasing from  $14.3 \pm 3.3$  to  $15.6\% \pm 3.9$ . Fibre also significantly increased up to  $22.3 \pm 7.9$  g/d. Both men and women significantly increased carotenoid intake and women increased folate intake. Plasma fatty acid measurements showed a significant decrease in palmitic acid and increases in oleic acid, alpha-linolenic acid, EPA and DHA. A significant increase in plasma folic acid, carotenoids and phenolic compounds was observed. In the prudent low fat, low cholesterol group at 3 months, total lipid decreased to 33.9%, SFA dropped to 10.3%, MUFA tended to decrease to 13.4% and dietary fiber minimally changed (20.6 g/d).

### Results : fasting biochemical parameters

At 3 months in the Mediterranean-diet group (vs the low fat, low cholesterol diet group), the following relative changes have been observed for the fasting biochemical parameters. Body mass index : - 5.1 % (vs - 3.9%); plasma total cholesterol : - 6.9 % (vs - 3.6%); LDL-cholesterol : - 9.3 % (vs - 2.2%); apoB : - 4.3 % (vs - 3.2%); HDL-cholesterol : + 1.5 % (vs + 0.03%); plasma triglycerides : - 9.3 % (vs + 3.9%); plasma glucose : - % (vs - %); plasma insulin : - 11.3 % (vs - 7.0%); HOMA score : - 12.5 % (vs - 10.7%). Except for HDL cholesterol, all these changes were statistically significant ( $P < 0.05$ ).

### Conclusion

As expected, subjects from French Mediterranean regions departed from Mediterranean traditional diet. The data obtained show that in subjects at risk changing from the nowadays habitual (westernized) diet to a Mediterranean-type diet (high MUFA and n-3 fatty acids, high fiber, high plant carotenoids and polyphenols) improves most blood biochemical parameters considered as risk factors for cardiovascular disease. The amplitude of the beneficial changes is less marked when changing for a prudent low-fat, low-cholesterol diet. Nevertheless, it appears that in Provence, an area which still rely (at least minimally) on traditional Mediterranean culture, recommendation of a healthy diet is mostly interpreted by the subjects by adopting a kind of Mediterranean diet.

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## WORKSHOP

# Alkalinizing effects of fruits, vegetables and potatoes

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Saturday, June 7<sup>th</sup>, 2003

2:00 pm

*Minos Conference Room*

Supported by :



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## Christian REMESY

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### BIOGRAPHICAL SKETCH

- Dr Remesy has a PhD in Physiology (University of Clermont-Ferrand, 1973) and a State Doctorat in Biochemistry (University of Clermont-Fd, 1982). He joined INRA as a Research Scientist in 1972 and as Senior Research Scientist en 1983. In 1998 he was appointed Chief of the Unit of Metabolic Diseases and Micronutrients.
- Dr Remesy's research focuses on human preventive nutrition and particularly on metabolic and digestive effects of fibers, bioavailability of polyphenols and health effects of plant foods.
- He has published more 150 original papers in peer-reviewed scientific journals and about 50 review papers. He is the author of 2 personal text books "Alimentation et Santé" 1994, and "Les bonnes calories", 1996.

### RECENT PUBLICATIONS

- *Bioavailability of ferulic acid is primarily governed by the food matrix rather than its metabolism in intestine and liver in rats.*  
Adam A, Crespy V, Levrat-Verny MA, Leenhardt F, Leuillet M, Rémésy C (2002) J. Nutr. 132, 1962-1968.
- *Whole wheat and triticale flours with differing viscosities stimulate cecal fermentations and lower plasma and hepatic lipids in rats.*  
Adam A, Levrat-Verny MA, Lopez HW, Leuillet M, Demigné C, Rémésy C (2001) J. Nutr. 131, 1770-1776
- *Bioavailability in humans of the flavanones hesperidin and narirutin after the ingestion of two doses of orange juice.*  
Manach C., Morand C., Gil-Izquierdo A., Bouteloup-Demange C. & Remesy C. (2003) Eur J Clin Nutr, 57: 235-242.
- *Strawberry anthocyanins are recovered in urine as glucuro- and sulfoconjugates in humans.*  
Felgines C, Talavera S, Gonthier MP, Texier O, Scalbert A, Lamaison JL, Rémésy C. (2003) J Nutr. 133:1296-301.



## ALKALINIZING EFFECTS OF FRUITS, VEGETABLES AND POTATOES

*Christian REMESY and Christian DEMIGNE*

Organic anions are chiefly supplied by plant foods, under the form of partially neutralised potassium salts such as K citrate, K malate and to a lesser extent oxalate or tartarate salts. Animal products are also liable to supply K salts, essentially as phosphate, but also as lactate as a result of fermentative (dairy products) or maturation (meat) processes. However, these K salts have little alkalinising significance. Fruits organic acidity is less neutralised by K than vegetable's, but these last are generally submitted to cooking processes: for example, boiled potatoes show a loss of K whereas oven cooking or high temperature frying rather concentrate K in the product.

Citrate and malate anions are absorbed in the upper digestive tract, and a substantial part is metabolised in the intestine mucosa, thus a reduced percentage of these anions appears in extrasplanchnic blood. Whatever their site of metabolisation, these anions virtually yield  $\text{KHCO}_3$  which is used by kidneys to neutralise fixed acidity. Fixed acidity essentially reflects the oxidation of excess sulfur amino acids to sulfate ions, and this process is mainly related to dietary protein level. Thus, it appears advisable to consume protein-rich foods (meat, fish or dairy products) together with high-K plant foods such as potatoes. Failure to neutralise fixed acidity leads to low-grade metabolic acidosis, with long term deleterious effects on bone Ca status, since Ca is mobilised to neutralise excess acidity, and on protein status since acidosis promotes proteolysis. Furthermore, low grade acidosis is liable to affect other metabolic processes, such as peroxidation of lipid structures. This situation seems frequent with classical western diets and could account for the relatively high incidence of osteoporosis and muscle protein wasting observed in aged people in Europe and Northern America. Providing a sufficient supply of K organic anions through potatoes, fruit and vegetable intake (at least 2 g equivalent K daily) should be recommended, fostering the incitative campaigns actually launched to promote intake of plant foods rich in complex carbohydrates and various micronutrients.



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## SESSION 3

# Mediterranean diet : genetics ? lifestyle factors ?

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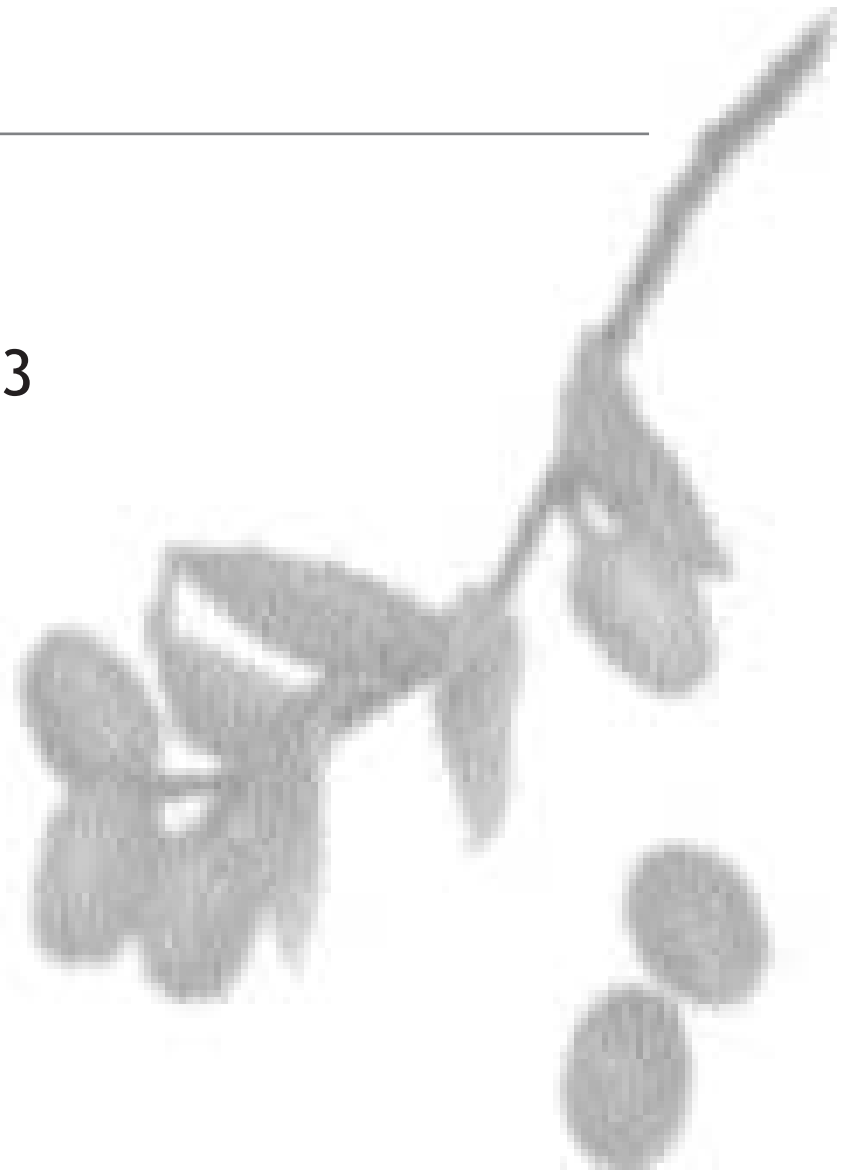
Sunday, June 8<sup>th</sup>, 2003

9:00 am

*Minos Conference Room*

*Chairmen :*

E. RIBOLI  
S. VOLLSET





## MEDITERRANEAN DIET: GENETICS ? LIFESTYLE FACTORS ?

*Stein Emil Vollset*

### INTRODUCTION

Understanding the contribution of the Mediterranean diet to health and longevity is complicated by the fact that we may not consider the Mediterranean diet as one single entity, but rather several dietary patterns with common features that are interweaved with, first, complex non-dietary Mediterranean life style patterns and, second, Mediterranean genetic profiles that differ from neighboring regions and other parts of the world.

Life style differences across Europe are illustrated with data from the EPIC study and translate into variation in, for example, smoking prevalence, physical activity, obesity, intake of folate, intake of alcohol and dairy products.

Genetic variation may modify the effect of life style and diet on health and longevity, and some of the variation in life style and diet may be due to genetic differences. We will briefly illustrate such phenomena with examples of variation in single nucleotide polymorphisms related to the metabolism of folate, alcoholic beverages and milk. The concept of 'Mendelian randomization' will be introduced and its usefulness in future work on diet, life style, genetic variation and health discussed.

### Literature

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2. Enattah NS, Sahi T, Savilahti E, Terwilliger JD, Peltonen L, Jarvela I. *Identification of a variant associated with adult-type hypolactasia.* Nat Genet 2002;30:233-7.
3. Willett WC. *Balancing life-style and genomics research for disease prevention.* Science 2002;296:695-8.
4. Davey Smith G, Ebrahim S. *'Mendelian randomization': can genetic epidemiology contribute to understanding environmental determinants of disease?* Int J Epidemiol 2003;32:1-22.



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### BIOGRAPHICAL SKETCH

- Denis Lairon is board certified in Biochemistry (Master, PhD, Doctorat ès-science Thesis).
- Since 1998 he has been Research Director of the INSERM Research U476, working on human nutrition and lipids : bioavailability, metabolism and regulation.
- In 1986 Dr. Lairon received the Fondation RONAC price.
- Dr. Lairon was member of the board (1992-98 then since 2000), and president (1995-98) of the French Nutrition Society, and member of the Editorial board of the British Journal of Nutrition (1997-2002).
- He is head of INSERM U476 and co-manager of the project for a Human Nutrition Research Center-Mediterranée associating laboratories in Marseille, Montpellier & Nice (Research Ministry).

### RECENT PUBLICATIONS

- *Genetic polymorphisms and lipoprotein responses to diets.*  
Proc Nutr Soc. 2002, 61: 427-434.
- *Butter differs from olive oil and sunflower oil in its effects on postprandial lipemia and triacylglycerol-rich lipoproteins after single mixed meals in healthy young men.*  
J Nutr. 2002 Dec, 132(12):3642-9.
- *Acute hyperinsulinism modulates plasma ApoB48-Triglyceride-Rich lipoproteins in healthy subjects during the postprandial period.*  
Diabetes. 2001, 50:462-469.
- *Mediterranean diet, fats and cardiovascular disease risk: what news?*  
Br J Nutr. 1999, Jul, 82(1):5-6.

## DIET, LIPID METABOLISM AND GENES : INTERACTIONS IN THE AETIOLOGY OF CARDIOVASCULAR DISEASE.

*Denis LAIRON, Stéphanie VINCENT and Richard PLANNELS*

*<sup>1</sup> Unité 476-Human nutrition and lipids at INSERM (National Institute of Health and Medical Research), Faculty of medicine*

Since their origin (about 7 millions years BC.), human diets have markedly evolved in the form of different patterns, from the hunter-gatherer way of life to Paleolithic-stone age, the Neolithic-early agriculture period and the present modern-agriculture age, with recent tremendous changes in industrialized-urbanized societies. At the same time, the human genome has only changed marginally and it is thought that minor changes that occurred through evolution and selection would have reinforced the humankind capacity to survive to hunger periods. Nevertheless, polymorphisms of common genes are now widespread in human populations with somewhat variable occurrence rates in some population sub-groups.

It has been substantiated that most major diseases (cardio-vascular disease, diabetes, obesity, cancers, ...) result from the interaction between genetic traits (susceptibility) and environmental factors, especially diet. In the field of lipoprotein metabolism and cardio-vascular disease, several gene polymorphisms for key proteins have been identified during the last decades (more than 250 SNPS in about 15 proteins). Some of these SNPs (Single Nucleotide Polymorphisms) have been linked to variable levels of biological parameters (plasma cholesterol, LDL-cholesterol, plasma triglycerides, haemostasis factors, hypertension) considered as risk factors for cardiovascular disease thus making a direct link between genetic traits, metabolic disorders and cardiovascular risk. The allelic frequencies of these SNPs can vary from 1/1000 to 1/2 in human populations. These SNPs can have different characteristics ; they can result in an alteration of the function of the encoded protein thus altering the metabolic pathway involved, they could have no known effect on protein function but are associated to altered levels of relevant parameters or they can affect the gene promoter activity thus affecting the tissue level of expression of a given protein of interest.

Interestingly, it has been reported in numerous cases that the presence of some SNPs is linked to variable responses to dietary manipulations. Such interactions have already been shown in response to high fat, cholesterol vs low fat, low cholesterol diets, for several apoproteins involved in lipoprotein trafficking such as ApoE polymorphisms (e2, e3, e4), ApoB (different locus), ApoAIV (variants 1 & 2), I-FABP (54 G/A), ApoC3, LDL receptor, MTP, CETP, lipoprotein lipase or hepatic lipase. Variable responses to high-carbohydrate diets or alcohol intake have also been described.

We are carrying out an intervention study (Medi-RIVAGE) dedicated to investigate the interactions between diets (Mediterranean or low-fat types vs habitual high-saturated fat western type), risk factors for cardio-vascular disease and gene polymorphisms, in about 250 patients randomized in two groups, for 3 and 12 months. The following SNPs have already been determined : Apo E(e2-e3-e4), ApoB(-516C/T), ApoCIII (SstI), ApoAIV (Ser347Thr), MTP (-493G/T), I-FABP (Ala54Thr), CETP (TaqIB), hepatic lipase (-480C/T) and lipoprotein lipase (- 93G/T).Some data obtained in about 170 patients after 3 month dietary intervention are available. We will report that some of the SNPs studied show interactions with diets regarding changes of particular parameters after 3-month regimens.

The data provided will add further evidence of the interaction between particular SNPs and metabolic responses to diets. The expected consequence of such new knowledge is the ability to improve dietary recommendations by taking into account known genetic variability within a given population, ie by targeting specific recommendations to susceptible groups or individuals at high cardiovascular risk.





## CHILDHOOD OBESITY AND PHYSICAL ACTIVITY

*Anthony G Kafatos*

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*Preventive Medicine and Nutrition Clinic*

Obesity in childhood is a social problem with serious health consequences. The problem has arisen as a result of surplus food supply and decreased physical activity leading to increased body stores of fat. Food choices and physical activity are closely related to children's attitudes and behavior in relation to health matters as well those of their parents and the social environment. There is a six-fold increase in the activity of children if both parents are active in comparison to inactive parents. Parental educational level is also closely related to children's activity and inactivity. The level of physical activity also has genetic influences.

Obese children have a larger number of cardiovascular risk factors than normal weight children. Correlations between cardiovascular risk factors and atherosclerotic changes have been found in autopsy data from the Bogalusa Heart Study, from 204 children and young adults who had died mainly as a result of accidents. Direct monitoring of obese children has demonstrated that they are less active in comparison with normal weight children. Obese children are less likely to participate in moderate and vigorous exercises compared to leaner children. Obese children are less fit than their normal peers. Using heart rate monitoring, it has been shown that there is a relationship between fat mass and time spent in sedentary activity during the day. This relationship does not demonstrate causality but it seems that inactivity maintains obesity. In a 12-month obesity intervention program, the relative weight reduced and the aerobic fitness improved. In addition to the direct positive effect on obesity, physical activity is associated with decreased blood pressure and a favourable lipoprotein profile with increased insulin sensitivity. Type 2 diabetes has been recently reported to appear in early adolescent years and is also closely related to obesity.

Childhood obesity is closely associated with increased adult cardiovascular morbidity and mortality as has been seen in a long term 40-year follow-up study. Similar results, provided by the Third Harvard Growth Study, demonstrated that the relative risk for all cause mortality and coronary artery disease mortality were 1.8 and 2.3 respectively for males who were overweight in adolescence in comparison with those with normal adolescent weight.

There appears to be a dose-response relationship to television hours and overweight and obesity. Television viewing induces a stillness that is related to much less caloric expenditure than that of any other sedentary activity such as computer games, reading or drawing. Television viewing is also related to increased snack consumption. The increase in children's inactivity seen in the last few decades is attributed to both increased television viewing and increased computer use. In the National Health and Nutritional Examination Survey (NHANES), the prevalence of obesity in 12-17 year olds in the USA increased as the number of hours of television watching per day increased in the USA.

A large proportion of children and adolescents are inactive. There is evidence of health benefits from regular physical activity in children but there are no guidelines with respect to what might be an appropriate activity level for children. Seven community intervention studies were found in a recent literature review based on physical activity, dietary change or both, which include anthropometric measurements. Only one study, which attempted to decrease the inactivity period in children, achieved significant reduction in the obesity indices in a six-month period. The long-term effects of this intervention are unknown. In one Australian intervention study with several intervention

modalities, only one combining school nutrition and physical activity achieved significant reduction in skinfold thickness in a 12-month period. The Child and Adolescent Trial for Cardiovascular Health (CATCH) with a longer intervention period (3 years) had no significant outcome in regard to body fatness.

The Cretan Study was a prospective six-year intervention study that commenced in 1992. It included all 6000 children born in three counties of the island of Crete registered in the elementary schools of Crete in 1992. From those children 4500 were assigned to the intervention group and 1500 served as controls. After complete pediatric, anthropometric, dietary, physical fitness and blood examination at baseline, a six-year health and nutrition education program took place. It took the form of an interactive course implemented after the teachers had received appropriate training. Educational material was provided to children, teachers and parents. A randomly selected number of schools from both intervention and control groups which included over 1000 children was used to evaluate the effectiveness of the intervention after three years and on completion of the programme.

A summary of the 10 year follow-up is presented here, 4 years after the discontinuation of the intervention. The body weight and BMI increased significantly less in the intervention group as compared to the controls ( $p < 0.001$ ). The performance in the shuttle run test indicated that aerobic capacity increased significantly more in the intervention group as compared to the control group ( $p < 0.001$ ). Obese children had significantly less aerobic capacity in comparison with non obese ( $p < 0.001$ ). The intervention group spent significantly more time in moderate to vigorous physical activities in comparison with the control group ( $p < 0.001$ ).

The reduction of total serum cholesterol was significantly greater in the intervention group as compared to the control group ( $p < 0.001$ ) while the ratio of total cholesterol to HDL increased significantly less in the intervention group in comparison with the control group ( $p < 0.05$ ). The intervention group had significantly better dietary intake and the children whose nutrient intake was below 60% of the RNI were significantly less in the intervention group as compared to the control group ( $p < 0.001$ ).

In conclusion, the epidemic of obesity in childhood can be controlled only by the introduction of intervention programs at all educational levels. Emphasis should be given to nutrition, physical activity and toxic substances. The involvement of parents and teachers is necessary to ensure a successful outcome.

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8. Pratt M. *Benefits of lifestyle activity vs structured exercise*. JAMA. 1999 27; 281(4): 375-6.

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**BIOGRAPHICAL SKETCH**

- Françoise Aubaile-Sallenave is member of the scientific committee of "The road of food in the Mediterranean Area." seminar in Naples (Profs. Massimo Cresta de la Sapienza of Roma and Vito Teti of the Cosenza university).
- Member of the scientific commission of "Anthropologia de la alimentacion : cocinas y habitos alimentarios a ambo lados del Estrecho". Direction : Isabel Gozales Turno, professor of anthropology in Sevilla University.
- Dr. Aubaile-Sallenave is president of the ICAF-France : International Comittee for Anthropology of food.

**RECENT PUBLICATIONS**

- *2001 : "Frying". In Carlo Petrini et Ben Watson (eds), Slow Food. Collected thoughts on Taste, Tradition, and the Honest Pleasures of food.*  
White River Junction Vermont, Chelsea Green Publishing Company. Pp. 50-54.
- *2000 : Odeurs en alimentation dans quelques sociétés de Méditerranée : Premiers résultats d'une enquête sur perception et reconnaissance.*  
In Bull et Mém. De la Sté D'Anthropologie de Paris, n.s.t. 12, 2000,3-4, p.373-395.
- *1996 : La Méditerranée, une cuisine, des cuisines.*  
Social Science Informations, vol. 35, n°1, Mars 1996 : 139-194.

## SOCIAL ANALYSIS OF THE MEDITERRANEAN DIET

*Françoise Aubaile-Sallenave (France)*

*Museum National d'Histoire Naturelle*

*Laboratoire d'Ethnologie - URA 882 CNRS*

As an ethnologue, I study the culture of a group of societies who are the arabo-muslim maghrebians. I shall first show what are the cultural basis of the Mediterranean diet whose many practices and knowledge are common to the societies of Maghreb ; then I shall try to explain how those practices and knowledge can have, nowadays, encouraged diet modifications with sometimes alarming consequences ; modifications which are essentially due :

to an easier access to some foodstuffs in particular sugar and sweet confections, as well as animal (and vegetal) fats,

to a bigger choice of food processing confections,

to the social prestige of those confections and sweet drinks.

In those societies, diet was roughly based mainly on cereals, vegetables and fruits ; some consumption in particular those of sweet (often with honey) and fat confections were very valued but were limited, till about fifty years ago, to feast' times. They become to-day, with sweet fizzy drinks, food of prestige, and so eaten on many more occasions.

Nevertheless, certain traditional practices of preserving, in particular those made with meats preserved in mutton fat or smen, smelted and strongly salted butter, could be badly managed.

Then, I shall expose how recent are the knowledge and use of the sugar (before it was the honey) and how it is strongly linked to the recent adoption of the tea, less one a century ago, both products which have been introduced together by the English during the XIXth century.

At last, I would like to underline how, in those societies for a long time confronted with an irregular diet, the prestige of the fattened bodies, sign of strength and beauty, has still a strong symbolic dimension.



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# *POSTERS*

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Poster Session :  
Friday, June 6<sup>th</sup>, 2003  
7:30 pm  
*Lida Conference Room*



## P01 FISH PROTEIN IMPROVES TOTAL ANTIOXIDANT STATUS OF STREPTOZOTOCIN-INDUCED DIABETES IN SPONTANEOUSLY HYPERTENSIVE RAT

*FO. Boukortt<sup>1</sup>, D. Ait Yahia<sup>1</sup>, J. Prost<sup>2</sup>, M. Bouchenak<sup>1</sup> & J. Belleville<sup>2</sup>*

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Hypertension is the major risk factor in the development of cardiovascular heart diseases. This risk is enhanced when this pathology is associated with diabetes.

**The aim** of the study was to determine the effect of fish protein on blood pressure, glycemia and antioxidant status in streptozotocin-induced diabetes in spontaneously hypertensive rats. 20 SHR were fed, for 2 months, diets containing 20% casein (C) or fish protein (FP). After 1 month of experiment, 10 rats were intraperitoneally injected with streptozotocin (65mg/Kg body weight). Total antioxidant status of blood, antioxidant enzyme activities [glutathione peroxidase (GPx), glutathione reductase (GSSH-Red) and superoxide dismutase (SOD)] and antioxidant substances (glutathione (GSH), nitric oxide (NO)) were determined on organs. Plasma vitamin C was analyzed. **The results** showed a decrease (-14%) of blood pressure in SHR rats fed fish protein as compared to those fed casein but an increase (+13,9%) of the pressure values in STZ-SHR compared to SHR-FP. Total antioxidant status was increased (+5,5%) in plasma STZ-SHR as compared to SHR-C and in STZ-SHR versus SHR-FP. Plasma antioxidant status was significantly higher (+8%) in SHR-FP as compared to casein and in STZ-SHR-FP versus casein (+10,5%). The resistance of blood red cells (RBC) to hemolysis was threefold lower in STZ-SHR compared to SHR-FP and in STZ-SHR-FP as compared to those fed casein. The activities of GSH-Px and GSSG-Red in liver and kidney were significantly elevated in STZ-SHR as compared to SHR-C or FP. SOD activity in liver and heart was increased in STZ-SHR-FP than in STZ-SHR-C and in STZ-SHR-FP as compared to SHR-FP. In kidney SOD activity was enhanced (+31%) in STZ-SHR-FP than in STZ-SHR-C. Total GSH concentration was 1,79-fold higher in STZ-SHR-FP than in STZ-SHR-C and 1.51-fold higher in STZ-SHR-FP as compared to SHR-FP, in heart. In liver, SHR-FP presented higher values of total GSH than SHR-C. Nitric oxide concentration was significantly increased (+46%) in STZ-SHR-FP versus C in kidney and in STZ-SHR-FP compared to SHR-FP (+59%). In heart, NO level was significantly higher in FP compared to C groups. FP diet involved a higher plasma C vitamin concentration as compared to C diet.

**In conclusion**, fish protein diet has a benefit effect on blood pressure only in SHR group and on the antioxidant status in particular in STZ-SHR and we must give a great interest to this protein as antioxidant supplementation in future treatment of degenerative diseases.

## P02 MOROCCAN DIET: IS IT MEDITERRANEAN?

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Diets around the Mediterranean Sea have long been praised for their health merits. However, these diets are not practiced uniformly across the Mediterranean countries (north/south, west/east) nor within countries (urban/rural, regional, poor/rich).

In Morocco, while most Mediterranean foods are produced and consumed, their intake level remains low and largely disparate among population groups. This paper will examine available data from national surveys to assess the practice of the Mediterranean diet by the different population groups.

The 1984/85 food consumption survey, obviously out-dated but the only available, showed that total intake of fish was 17g/p/day (27g urban and 9.5g). That of vegetables was 289g/p/day (356g urban and 238g rural). That of fruits was 87g/p/day (113g urban and 68g rural). Total fat intake was 67 g/p/day, two-thirds of which were provided by oils and only 12% by olive oil. The latter's intake was below 8g/p/day (5g urban and 10g rural). All these figures were naturally lower for low-income classes.

The 1998/99 expenditures survey indicates that fish expenditure reaches barely 3.3% of total food expenditures in urban areas and only 1.7% in rural areas. Those of Fruits and vegetables are less than 10% in urban areas and less than 15% in rural areas.

Morocco is going through a nutrition transition, occurring simultaneously with demographic and epidemiological transitions. Indeed, the 1998/99 national survey showed that overweight affects 36% of the adult population and 50% of urban women. The rate of hypertension in 2000 was 33% and that of diabetes is more than 10%. This situation calls for an examination of the risk factors, among which, diet and physical activity. Therefore, the evaluation of the Moroccan diet will help determine how it compares with the appreciated healthy Mediterranean diet. The results could be used as a base for nutrition education among the population.



### P03 FRUITS AND VEGETABLES CONSUMPTION IN RELATION TO CARDIOVASCULAR DISEASE PROFILE OF GREEK MEDICAL STUDENTS

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**Introduction :** Diet is related to the onset and progression of many chronic diseases, including cardiovascular diseases (CVD). Fruits and vegetables are considered important food groups in terms of chronic disease risk reduction. To date, however, their association with the CVD profile of young Greek adults has not been examined. Objective: To investigate the fruits and vegetables intake of medical students in Greece and its relationship to major CVD risk factors.

**Materials and Methods :** A total of 523 third-year medical students (299 men, 224 women) aged  $22 \pm 2$  years were examined in the context of the Clinical Nutrition class of the University of Crete School of Medicine. Trained nutritionists conducted a 24-h dietary recall to each participant, and anthropometric measurements and blood chemistries were performed. Purpose designed lifestyle questionnaires were used to assess the use of tobacco.

**Results :** Ninety percent of the male and 94% of the female students reported consuming fruits and/or vegetables,  $327 \pm 273$  g/day and  $358 \pm 285$ g/day respectively. Only 31% of those who smoked reached the population goal of 400g/day consumption, in contrast to 41% of the non/ex-smokers ( $p < 0.05$ ). Fruits and vegetables consumption was inversely related to the obesity status of the medical students. After controlling for age, sex, tobacco use, and body mass index, fruits and vegetables consumers had lower total cholesterol ( $175.9 \pm 1.5$  vs.  $192.1 \pm 5.2$  mg/dl,  $p = 0.003$ ) LDL-cholesterol ( $110.8 \pm 1.4$  vs.  $126.9 \pm 4.5$  mg/dl,  $p = 0.001$ ), and TC:HDL-C ratio ( $3.68 \pm 0.05$  vs.  $4.26 \pm 0.17$ ,  $p = 0.001$ ) than non-consumers. No differences were observed in blood pressure values.

**Conclusions :** Fruits and vegetables intake was associated with a better CVD profile in Greek medical students. Encouraging the consumption of these food groups may be an important step in reducing the prevalence of CVD risk factors in early adulthood.

### P04 LUTEIN, LYCOPENE AND BETA-CAROTENE REDUCE THE OVAL CELL REACTION IN THE RESISTANT HEPATOCYTE MODEL OF HEPATOCARCINOGENESIS

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**Introduction:** The interest in carotenoids as potentially active substances for the cancer prevention is increasing. In the resistant hepatocyte model of carcinogenesis, when liver damage is so severe that hepatocytes are extensively killed or that their proliferation is prevented by exposure to hepatotoxins/carcinogens, oval cells appear in the periportal areas of liver lobules.

**Objective:** The effect of beta-carotene (BC), lutein (LU) and lycopene (LY) over oval cell proliferation was investigated.

**Materials and methods:** Wistar rats were separated in four groups ( $n=10$ ). The groups treated with LY or BC or LU received the carotenoids (70mg/kg BW) and the control group (CO) received only corn oil. At the end of 8 weeks, livers were processed for light microscopy. Ductular cells could be distinguished on H&E and were GSTP positive. Images of 15 periportal zones per slide were considered and a reticule of 500 points was superposed to the image on the monitor. The number of intersections coincident with oval cells was counted. The volume fraction occupied by oval cells was obtained by the percentage of points counted in relation to the total intersections.

**Results:** A statistical difference was observed between the volume fraction in periportal zones of rats treated with corn oil and the groups treated with carotenoids. The values were:  $17.1 \pm 13.6a$  (CO);  $10.4 \pm 7.0b$  (BC);  $12.4 \pm 7.5c$  (LY); and  $9.8 \pm 6.8b$  (LU).

**Conclusion:** These results are in agreement with the quantification of GSTP-positive lesions in these livers, comet assay data, and reinforce the chemopreventive activity displayed by these carotenoids.

## P05 EVALUATION OF THE NUTRITIONAL SITUATION DETERMINANTS IN TANNANT (MOROCCO) USING POSITIVE DEVIANCE APPROACH

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In each community, there are individuals whose not very common practices and behaviors allow them either, to avoid a problem or, to find better solutions with the problems than their neighbors, who have access to the same resources. The survey on these positive deviants makes it possible to know what they do moreover than the other members of the community: unusual strategies and behaviors to deal with the threat of malnutrition.

To identify the causes of malnutrition in Tannant population, we first investigate the food habits and practices, care and health concerning the young children and their parents.

The nutritional status is measured using anthropometry. The food consumption is evaluated using 3 twenty-four hour recalls. Behaviors and practices are followed using ethnography.

The findings of studying the positive deviants will contribute to develop an education package aimed at alleviating nutritional stress in the studied community.

The advantage of the Positive Deviance approach is that is based on the local resources, it respects the cultures and knowledge of the populations and it allows a better use of the local resources to alleviate stresses.

## P06 CORONARY RISK FACTORS AND THEIR RELATIONSHIP WITH SATURATED FAT CONSUMPTION IN YOUNG ADULTS BORN IN WARSAW (PRELIMINARY DATA)

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**Objective:** The main aim of the study is to investigate the relationship between birth weight and coronary risk factors in young adults aged 24-28 years. In the current preliminary presentation we show data concerning the incidence of coronary risk factors and their relationship with saturated fat consumption and BMI.

**Materials and Methods :** 1900 young adults born in one district of Warsaw in 1974-77, whose mothers participated in the prospective follow-up from the first visit during pregnancy till delivery, take part in this study. 1600 were invited until now. 327 (17,3%) underwent the examination.

**Results :** In the whole group of 327 people the most common were such risk factors as high (>10% en) consumption of saturated fatty acids (66,6%) and sedentary life-style (60,6%). Overweight (BMI 25-29,9) occurred in 22% and obesity (BMI≥30) in 9,5%. Hyperlipidemia occurred in 21,4%. Almost all risk factors were correlated with BMI. Serum LDL cholesterol, glucose, HbA1c and WHR correlated positively with saturated fatty acids consumption.

**Conclusions :** 1. Frequency of coronary risk factors in young adults is significant. 2. Serum insulin, glucose, TG, LDL, fibrinogen, HBA1c and blood pressure were positively correlated with BMI; HDL-chol was negatively correlated. 3. Serum LDL cholesterol, glucose, HbA1c and WHR correlated positively with saturated fatty acids consumption 4. It is important to implement prevention and treatment of coronary risk factors in young adults. It concerns mainly life-style measures. 5. The relationship of coronary risk factors with birth weight will be the subject of separate report.

**P07 INTAKE OF LINOLEIC AND ALPHA-LINOLENIC ACIDS, AND DIETARY ORIGINS IN A FRENCH POPULATION. RELATIONS WITH PLASMA AND ADIPOSE CONTENTS**

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**Introduction :** In France, the optimal levels of linoleic acid (LA) and alpha-linolenic acid (ALA) in the diet for optimal growth and health have been revised in 2001 and set at 4% of LA and 0.8% of ALA (% of total energy : en%). However, scarce data of actual dietary intake are available, especially regarding ALA.

**Objectives:** The objectives of this study were to assess the levels of LA and ALA supplies of a French population and to investigate relations between intake and occurrence of LA and ALA in plasma and adipose tissue.

**Materials and Methods:** One hundred forty women (79 non-pregnant women and 61 pregnant women) recorded the foods they consumed for 7 days.

**Results :** The average values were found to be 8.9 g/d (i.e. 4.4 en%) for LA intake and 0.7 g/d (i.e. 0.34 en% for ALA intake. The main dietary source of ALA was animal fats (75% of total ALA) among which dairy produce were the most prevalent (46%), with 13.2% represented by cheeses, 11.5% by pastries, 9% by yoghourts, 8.3% by butter and 4% by milk. 8% of ALA were provided by fruit and vegetables, 9% by vegetable oils. LA and ALA levels were respectively 14% and 0.5% of total fatty acids in adipose tissue ; they were respectively 27% and 0.5% in plasma total lipids. In plasma, these fatty acids were mainly incorporated into cholesterol esters (CE) (53% LA and 0.42% ALA). Moreover, LA percentage value in CE was positively correlated with that found in adipose tissue ( $r = 0.606$  ;  $p < 0.001$ ).

**Conclusions :** average LA supply (4.4 en%) is actually in accordance with the recommended value, whereas ALA supply is too low. Strategies, such as food enrichment, must be found to increase the ALA intake.

**P08 CULTURES AND FEEDING HABIT IN THE TUNISIAN DIET**

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**Introduction :** In recent years, the international scientific community unanimously recognizes the benefits of the Mediterranean Diet. They have concluded that this diet is one of the most healthful in the world in terms of preventing such illness as heart disease and cancer, and increasing life expectancy. The North African country of Tunisia adhere to principles of the Mediterranean Diet before times.

**Materials and Methods :** This presentation gives an analysis overview of papers, reports and data about feeding habit, ingredients, recipes and local ways of cooking of Tunisian diet.

**Results :** The cuisines and culinary practices of the Tunisian diet have several things in common with the mediterranean region. The products and traditions of the Romans, Phoenicians, Carthaginians, Arabs have crossed paths during centuries of maritime trade, enriching and developing the Tunisian diet. In North Africa and Tunisia, couscous vegetables and legumes form the center of the diet.

**Conclusions :** The traditional Tunisian diet have basic similarities with the mediterranean diet. But, the urbanization brought changes to the Tunisian cuisine. New recipes, new ways of presentation and a number of processed foods. The Tunisian cuisine today is the product of local cuisines and foreign influence.

## P09 THE NUTRITIONAL VALUE OF SPROUTED SEEDS IN THE DIET

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**Introduction :** We present a review of studies on the nutritional value of sprouts grown from various seeds including legumes, broccoli and sunflower seeds. There is evidence of the content of vitamins A, B, and C as well as minerals including calcium, iodine, and zinc in the sprouts of mung beans, sunflower seeds and other beans and seeds. Broccoli sprouts are a rich source of phytochemicals such as sulforaphane, making them many times more potent than broccoli itself.

**Objectives:** Our objectives in this survey of the literature were to compile published information and to validate the nutritional worth of various sprouts as assessed in these studies.

**Materials and Methods :** This research started with our thesis "Viable Responses to World Food Concerns of Production and Distribution: Aquaculture and Hydroponics" (Master's Degree 1989) Since then, we have followed the field and added information regularly. The later studies are on work done with broccoli sprouts isolating sulforaphane because of its ability to protect cells against cancer. Continuing investigations involve helicobacter pylori. The preliminary results offer an exciting possibility of an effective treatment of ulcers with broccoli sprouts.

**Results :** In addition to their nutritional value, sprouting seeds in households provides fresh, organic produce in 3 - 5 days, a big step toward food security. For bioavailability, sprouts rank very high. Because of possible contamination with E.coli, some experts now advise cooking them rather than eating them raw. In climate extremes; in conditions of drought and flooding when fields are not available for cultivation; in times of war; in situations where transportation is a problem due to availability or cost, sprouting seeds locally can provide fresh food on a sustainable basis.

**Conclusions :** This technique of producing food is a positive contribution to health, as well as to social and environmental concerns.

## P10 THE IMPACT OF THE TRADITIONAL CRETAN MEDITERRANEAN DIET ON THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS

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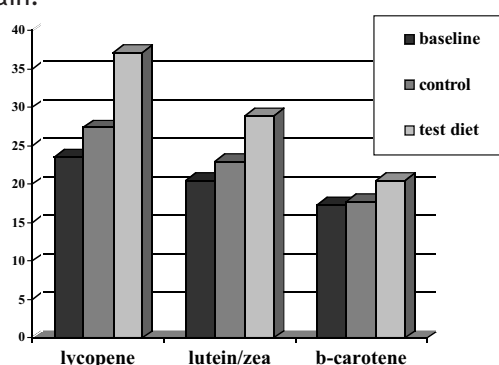
**Objective:** To investigate the impact of the traditional Cretan Mediterranean diet on metabolic control and weight management in Australian-born people with type 2 diabetes.

**Study Design:** Randomised cross-over study with 3 months on control usual diet or a reconstructed Cretan Mediterranean diet followed by 3 months of the other diet. The subjects were 27 Australian-born people, aged 47-77 years, with type 2 diabetes. The traditional Cretan Mediterranean diet was provided ad libitum in a wide variety of prepared modules.

**Methods:** Markers of glycaemic control, lipid profile, blood pressure, biochemical markers of dietary quality (plasma carotenoids, plasma fatty acids, red cell folate), homocysteine, body weights and body composition (by DEXA) were monitored.

**Results :** Following intervention on the test diet subjects experienced improvements in glycaemic control and insulin resistance (HOMA method). Significant increases in serum carotenoid levels (lycopene, lutein/zeaxanthin and b-carotene) were observed as shown in Figure 1. No significant changes in body composition were observed.

**Conclusions:** The traditional Cretan Mediterranean diet can be successfully implemented in the treatment of diabetes with modest benefits in metabolic control. Furthermore, we have shown that this relatively high fat diet provided ad libitum did not lead to weight gain.



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**P11 FOLIC ACID, VITAMIN B12 AND HOMOCYSTEINE STATUS IN ELDERLY MEN AGED 80 AND OVER : DIFFERENCES BETWEEN CRETE AND ZUTPHEN (NL)**

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**Introduction :** Low levels of folate, vitamin B12 (cobalamin) and corresponding high levels of circulating homocysteine have been associated with an increased risk of coronary heart disease, colon cancer and cognitive disorders in elderly people.

**Objective:** A comparison is made of the levels of folate, vitamin B12 and homocysteine in sera of elderly men in two cohorts of the Seven Countries Study, the Cretan (GR) and the Zutphen (NL) cohort.

**Materials and Methods :** For this cross-sectional analysis blood samples were collected between March and August 2000 from 147 men living in or near Zutphen and 128 men living on Crete, all aged 80 years or over. The sera were assayed for folic acid, vitamin B12 (clinical autoanalyzer) and homocysteine (HPLC) in one laboratory. Analyses of covariance were used to calculate age-adjusted means and to test for significant differences between the cohorts.

**Results :** The geometric mean level of serum folate was significantly higher in men from Crete (6.42 ng/ml) compared to men from Zutphen (4.80 ng/ml) ( $p < 0.001$ ), whereas vitamin B12 levels were lower (355 pg/ml and 432 pg/ml, respectively,  $p < 0.001$ ). These differences can probably be explained by the higher vegetable and fruit consumption in Crete and the higher consumption of meat and dairy products in Zutphen. Analyses of consumption data have not been performed yet. Surprisingly, serum homocysteine levels were higher in men from Crete (23.7 mmol/l and 18.4 mmol/l, respectively;  $p < 0.001$ ). Within the Zutphen and Cretan cohorts, however, inverse correlations were found between serum folate and homocysteine as expected (Spearman correlation coefficients were -0.37 and -0.34, respectively, both  $p < 0.001$ ).

**Conclusions :** Elderly men from Crete have significantly higher levels of serum folate and lower levels of serum vitamin B12 probably due to dietary differences.

**P12 NUT INTAKE IN THE EPIC STUDY AND COLORECTAL CANCER RISK: GENDER AND SITE SPECIFIC PROTECTIVE EFFECTS**

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**Introduction :** Nuts are an important part of a Mediterranean Diet and have been shown to be protective of heart disease and prostate cancer, probably due to their unsaturated fatty acid or phyto-nutrient/estrogen content. However, the effects of nuts on colorectal cancer (CRC) are unknown.

**Objective:** To determine the effects of nut intake on CRC risk within the EPIC study.

**Methods :** Total nut intake was determined from country-specific dietary questionnaires for 855 (Male(M)=327; Female(F)=528) colon cancer cases, 474 (M=215; F=259) rectal cancer cases and 476,711 controls (M=141,446; F=335,265). A multivariate Cox proportional hazard model, stratified by center, controlling for fruit and vegetable intake, energy from alcohol, energy from lipids, energy from other sources, height, weight, sex and age, was used. Relative risk estimates were obtained from nut intake (i) categorized in non-sex-specific, cohort wide quintiles and (ii) in a linear log transformed model.

**Results :** No significant protective effects of nut intake on CRC risk were observed in either males or females. However, division of the data into colon and rectal cancers showed a significant protective effect of nut intake on colon cancer in females at the highest quintile of intake compared to the lowest in the categorical model (OR=0.687; 95% CI=0.499-0.945), and with increasing intake of nuts in the continuous model (OR=0.878; 95% CI=0.789-0.977). No significant effects were observed for colon cancer in males or for rectal cancer in either gender. From this data, it is not evident why a sex difference exists or why it may be limited to the colon and not the rectum.

**Conclusions :** The EPIC study has shown a significant protective effect of increased nut intake on colon cancer in women, with no effects on rectal cancer for either gender.



**P13 READY-TO-EAT CEREALS CONSUMPTION IN RELATION TO ANTHROPOMETRIC INDICES, PHYSICAL FITNESS, AND DIETARY INTAKES AMONG CRETAN HIGH SCHOOL PUPILS, GREECE**

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**Introduction :** Diet in childhood is considered important for the development of chronic disease in later life. Little is known, however, with regard to the association between consumption of ready-to-eat cereals (RTEC) and diet and health indicators in children and adolescents.

**Objective:** To investigate the consumption of RTEC among adolescents in Crete, Greece, and examine associations with anthropometric indices, physical fitness level, and nutrient intakes.

**Materials and Methods :** A representative sample of 392 pupils (183 boys, 209 girls) aged  $15 \pm 0.4$  years, attending high schools in Crete, was selected for the purposes of the study. Anthropometric measurements were performed, and the physical fitness of the pupils was evaluated with the 20m-endurance run test. Trained nutritionists conducted 24-h dietary recalls interviews and addressed a set of questions to determine the frequency, patterns, and type of RTEC consumed by the pupils.

**Results :** Regular consumption of RTEC (at least once/week) was reported by 42.1% of boys and 43.1% of girls. 43.7% of the pupils ate RTEC at meals other than breakfast. Compared to non-consumers, daily RTEC consumers ( $\geq 5$  times/week) had lower values of the body mass index (mean  $\pm$  SD;  $21.9 \pm 0.6$  vs.  $23.4 \pm 0.3$  kg/m<sup>2</sup>), waist circumference ( $73.2 \pm 1.5$  vs.  $76.6 \pm 0.7$  cm), waist-to-height ratio ( $0.43 \pm 0.01$  vs.  $0.46 \pm 0.01$ ) ( $p < 0.05$  in all analyses), and fasting plasma glucose ( $70.1 \pm 2.2$  vs.  $77.9 \pm 1.1$ ,  $p < 0.01$ ). Subjects who ate RTEC had also better performance on the endurance test. Cereals-consumers had significantly higher intakes of calcium, iron, fibre, folate, and vitamin B2 than non-consumers.

**Conclusions :** Regular consumption of RTEC was favourably associated with many health and diet indicators in Cretan high school pupils. RTEC consumption may be a beneficial factor in the diets of young children and adolescents, with potential implications for improved health status and reduced risk of disease in adult life.

**P14 VEGETABLES AND FRUITS CONSUMPTION IN YOUNG PEOPLE IN NORTH OF FRANCE**

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**Introduction :** It is usually said that school boys and girls do not eat vegetables and fruits because they don't like it. But few data are available on that topic, especially on sociological factors which could explain that situation. Since dietary habits during youth may be important for forthcoming health of children it is worth to know that food intake.

**Objective :** The purpose of that study was to know the vegetables and fruits consumption in young people, the nutritional consequences and the factors explaining that consumption.

**Material and methods :** We have investigated 201 schoolchildren from 10 to 20 years with a four days dietary record in some schools in North of France with the SUVIMAX photo-booklet.

**Results :** The mean consumption of fruits was  $67,9 \pm 79,9$ g/d and the mean consumption of vegetables was  $178,3$  g/d including  $103,2$  g/d of potatoes (which are vegetables but often excluded from that group by some public health and nutrition committee in France). 28,8 % of the subjects do not consume fruits. Girls consume more fruits than boys ( $78,2$  g/d vs  $53,9$  g/d). Children whose mother is born in France eat less fruits than children whose mother is born in another country ( $65,3$  g/d vs  $94,2$  g/d). Children whose father is born in the North of France eat less fruits than children whose father is born in another region of France ( $59,1$  g/d vs  $118,4$  g/d). Children whose parent's job is socio economically higher eat more fruits than children whose parent's job is socio economically lower. Children who eat more than  $117$  g/d fruits have higher intake in fibers, vitamins A, D, C, B, B5, B6, B9, magnesium and potassium than those who eat less than  $25$  g/d of fruits. Children who eat more than  $248$  g/d vegetables have higher intakes of energy, carbohydrates, proteins, fats, fibers, vitamins A, E, C, B1, B3, B5, B6, B9, magnesium, phosphorus, potassium, iron, than those who eat less than  $98$  g/d vegetables. There is no relation between fruits or vegetables consumption and height, weight and body mass index of the subjects (9,5 % of school children are obese and 12,4 % are overweight)

**Conclusion :** Among school children from 10 to 20 years in North of France, fruits and vegetables is low and particularly fruits consumption is linked to many sociological and cultural parameters. Higher consumption of fruits and vegetables is associated with higher micronutriments and energy intakes but there is no relation with body mass index. That could reflect also some differences into lifestyle. These data will be discussed.

## P15 HEALTH AND DIETARY SELF-ASSESSMENT OF GREEK MEDICAL STUDENTS AS AN EDUCATIONAL TOOL ON NUTRITION TEACHING

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**Introduction :** The search for more effective modes of teaching nutrition appears to be receiving increasing attention. The Clinical Nutrition course at the University of Crete emphasizes the role of health and dietary self-assessment in teaching nutrition to medical students.

**Objective:** To report our twelve year experience in using health and dietary self-assessment as an educational tool.

**Materials and Methods :** During the course, a 24-hour dietary recall questionnaire is administered by dietitians to all third-year medical students and anthropometric measurements and blood analyses are performed. Individual nutrition analyses and health reports are discussed by the students and the staff in small-group interactive sessions. At the end of the course students are asked to evaluate the course.

**Results :** From 1989 to 2001, 989 third - year medical students attended the Clinical Nutrition course. The response to the nutrition assessment was overwhelming positive and it was gratifying to receive a high participation (98%) and cooperation from the students. In the course evaluation 91% of the medical students enjoyed dietary assessment exercise and 90% benefited from it, while the percentages of negative responses were only 2% and 4% respectively. The discussion following health and dietary assessment was considered useful in terms of acquiring knowledge and improving students' health habits.

**Conclusions :** Dietary assessment can play a significant role in teaching nutrition to future medical practitioners. The use of personalized data provided by self-assessment can give more relevance to the content of clinical nutrition and enhance the learning process.

## P16 DIETARY FIBRE INTAKE IN RELATION TO DIET AND HEALTH STATUS OF GREEK MEDICAL STUDENTS AT THE UNIVERSITY OF CRETE SCHOOL OF MEDICINE

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**Introduction :** Dietary fibre, an essential component of the Mediterranean diet, is associated with important health benefits in adulthood, especially in terms of reducing the risk of cancer and cardiovascular disease (CVD). There is no published data on fibre intake in young adult populations in Greece and relationships with diet and other health indicators.

**Objective:** To assess dietary fibre intake by Greek medical students and examine associations with daily nutrient intake and CVD risk factors.

**Materials and Methods :** A total of 951 third-year medical students (500 male, 451 female) from various regions in Greece, aged  $22 \pm 2$  years, were examined in the context of the Clinical Nutrition class of the University of Crete School of Medicine. Trained nutritionists conducted a 24-h dietary recall to each participant and anthropometric measurements, blood pressure recordings, blood analyses and smoking assessment were performed. "High" and "low" fibre intake was defined using upper and lower energy-adjusted fibre intake quartiles for each sex.

**Results :** The mean fibre intake was  $16.9 \pm 10.7$ g for males and  $13.7 \pm 10.1$ g for females ( $p < 0.001$ ). The lower quartile cut-off for energy-adjusted fibre intake was 4.3g/1000kcal for men and 4.5g/1000kcal for women and the corresponding upper quartile cut-off was 9.2g/1000kcal for men and 11.1g/kcal for women. "Low" fibre eaters had higher intakes of energy, total fat, saturated fatty acids, cholesterol, protein and sodium ( $p < 0.001$  for all nutrients) than those with "high" fibre intake. Energy-adjusted fibre intake was positively associated with intakes of iron ( $p < 0.001$ ), folate ( $p < 0.001$ ), magnesium ( $p < 0.001$ ), potassium ( $p < 0.001$ ), vitamin C ( $p < 0.001$ ), vitamin A ( $p < 0.001$ ), vitamin E ( $p < 0.05$ ), and vitamin B6 ( $p < 0.001$ ). No statistical association was observed between fibre intake and anthropometric measurements, systolic blood pressure, serum lipoproteins or tobacco use.

**Conclusions :** Our data suggest that fibre intake among medical students was strongly related with a healthier dietary pattern. Medical students should be encouraged to consume fruits, vegetables, legumes, cereals and other food groups with high content of fibre.

**P17 MONITORING FOOD HABITS IN THE MEDITERRANEAN REGION THROUGH THE DAFNE DATABANK***E. Oikonomou, A. Naska, K. Tsiotas & A. Trichopoulou*

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**Introduction :** The term "Mediterranean diet" is used to denote dietary practices in the olive-growing areas of the Mediterranean basin, as these were described in the 1960s.

**Objective:** To monitor dietary practices in four Mediterranean countries (Greece, Italy, Spain and Portugal) and to further compare them with the characteristics of the 'Mediterranean diet', as originally described.

**Materials and Methods :** The DAFNE (Data Food Networking) databank, which includes information collected in the household budget surveys, was used to retrieve nationally representative dietary data for the four countries. To allow comparisons over time both within and between countries, data were harmonized according to the DAFNE methodology. The mean availability (g/person/day) of eight components of the Mediterranean diet (olive oil/cereals/vegetables/fruits/legumes/dairy products/meat/fish) were estimated, based on data covering the period from 1980 to 1999. Food availability was studied to describe dietary practices in the region, to assess overtime changes and to identify deviations from the traditional diet.

**Results :** Data confirm the diverse expressions of Mediterranean diet. When compared to Greece Portugal and Spain, Italy is the highest consumer of cereals, mostly attributed to the high pasta consumption. Vegetables are preferably consumed in Greece; Spain and Portugal favor the consumption of fish and seafood. Olive oil is the prevailing added lipid in Greece, Italy and Spain, while in Portugal seed oils are commonly consumed. In contrast to the past, meat availability is high in all countries and exceeds 130g/person/day. In recent years, a general decrease is noted in the availability of olive oil and plant foods. The bigger deviation from the traditional diet concern the increase in meat and cheese and the decrease in fruit availability.

**Conclusions :** Despite the worldwide acceptance of the beneficial effects of the Mediterranean diet, people in the region have progressively departed from their long-standing tradition. The need for a nutritional policy that would address this issue has become imperative.

**P18 FACTORS INFLUENCING CHANGES IN DIETARY HABITS AT FAMILY LEVEL IN A MIDDLE-INCOME NEIGHBOURHOOD OF BEIRUT, LEBANON***T. Hoérée<sup>1</sup>, M. Nehlawi<sup>2</sup>, R. Afifi Soweid<sup>2</sup>, R. Nakkash<sup>2</sup>, N. Najjar<sup>2</sup>, R. Mourtada<sup>2</sup>, M. Khogali<sup>2</sup> & A. Pérez-Cueto<sup>1</sup>*

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**Introduction :** In a middle-income neighbourhood of Beirut, Lebanon, with high levels of obesity (38%) a community health promotion project was initiated. The nutrition education activities consisted of classes and cooking sessions on preparing a healthy diet for groups of women.

**Objective:** The aim of the study was to understand the conditional factors for changing the family diet in a group of women that participated in the nutrition activities.

**Materials and methods:** In a qualitative study 28 participants of the nutrition activities were interviewed (semi-structured). Coding and analysis of the transcripts was done in two rounds and was assisted by QSR-Nudist5 software package.

**The results :** Major reported dietary changes were reduction of fat intake and increase in vegetable consumption. Two major determinants of change in family diet were identified: the initiating cause for change and the family dynamics. Most families where one of its members had a cardio-vascular disease had already experimented with dietary changes. When the incident befell the husband, changes were more often extended to all family members. The educational sessions were beneficial for reinforcing or incrementing the already introduced changes. Women in families that were incident-free participated in the educational sessions for reducing future risks or for increasing their "healthy feeling". Most of these families experimented with changes during the course of the project. Children had a powerful voice in maintaining the changes

**Conclusions:** Acceptance and maintenance of dietary changes introduced via the mother depend on her negotiating power. Depending on the initiating cause she will get support from different family members. Effectiveness of interventions could be enhanced by learning women to better manage family dynamics. Specific interventions should also be designed for each causal condition.



**P19 ASSOCIATION BETWEEN CARDIOVASCULAR DISEASES AND ADDITIONAL EATING DURING THE NIGHT***M. Rguibi & R. Belahsen*

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**Introduction :** Additional eating after evening meal is widely known in the Saharan woman in south of Morocco and consists in a traditional overeating related to the perception culturally valorising obesity. Does this subculture can lead to cardiovascular diseases?

**Objective:** The aim was to examine the association between obesity, hypertension, diabetes and additional eating during the night in a urban women of south Morocco.

**Materials and Methods :** 180 urban women aged 15-70y, of mostly Saharan origin, not pregnant. Body weight, height, plasma total cholesterol, triacylglycerols, glycaemia and blood pressure are measured. All subjects completed a diet and lifestyle questionnaire at recruitment, giving details of their usual diet. The sample was divided in two groups according to their answers to the food habit questionnaire as either consuming additional eating after evening meal (group1) or not (group2). Obesity was defined by body mass index BMI $\geq$ 30.

**Results :** The results showed that the prevalence of obesity, hyperglycaemia, hypercholesterolemia and hypertension was higher in group 1 than group 2. Energy intake after evening meal was significantly correlated with BMI.

**Conclusions :** The results demonstrated that over-consumption with additional energy intake after evening meal may be one explanation of the apparent higher prevalence of cardiovascular diseases risk in Saharan women in south Morocco.

**P20 CORRELATION OF PHYSICAL ACTIVITY WITH DIET AND OBESITY IN CHILDREN***K. Sarri, M. Linardakis, F. Bervanaki, A. Kafatos*

Preventive Medicine and Nutrition Clinic, Department of Social Medicine, Faculty of Medicine, School of Health Sciences, University of Crete, PO Box 1393, Heraklion, Crete, Greece.

**Introduction :** Childhood obesity is reaching epidemic proportions in Greece. Increased physical activity and improved dietary habits are the main strategies for primary prevention and treatment of obesity.

**Objective:** The aim of the present study was to examine the relationships of children's physical activity with obesity indices and dietary data.

**Materials and Methods :** A total of 634 children (14-16 years) were examined in 2001-2. A 24h-physical activity questionnaire was obtained by interview and the shuttle run test (SRT) was performed. The dietary analysis was based on the 24h-dietary recall, while obesity was defined by BMI. The 24h-Physical activity was divided in 3 major categories: A:Reclining/Sleep/Watching TV, B:Very Light/Light activities, C:Moderate/Vigorous activities.

**Results :** Triglycerides and LDL-C were inversely related to C and B activities respectively, while the ratio TC/HDL-C was positively related to A activities ( $p<0.05$ ). Although BMI was inversely related to A activities, our findings showed that obese children had a significantly lower score in SRT. SRT was negatively associated with A activities and positively with C activities ( $p<0.05$ ). Boys, as compared to girls, spent fewer hours on A and B activities and more hours on C activities both in weekdays and weekends.

However, when the food consumed was categorized into food groups, it was found that a) large consumption of dairy products was related with significantly less hours spent on A activities and more on B activities, b) consumption of cereals and meat was positively associated with A activities while the latter was also negatively associated with B activities. No correlations were found for other food groups like fruit and vegetables, snacks, sugar, soft drinks, fats and oils, fish and seafood, and eggs, or nutrient intake.

**Conclusions :** The above findings indicate that high physical activity reduces the levels of triglycerides and LDL-C while endurance capacity is inversely related to obesity.

**P21 THE MEDITERRANEAN DIET SCORE: A USEFUL MEANS OF EVALUATING DIETARY CHANGE?***JA. Scott, V. Dilis, CR. Hankey, WS. Leslie & MEJ. Lean*

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**Introduction :** The traditional Mediterranean dietary pattern, recognised for both its palatability and health benefits, has been quantified as a simple to use diet score calculated from 8 dietary components [1]. A high score is defined as  $\geq 4$ .

**Objective:** The aim of the present study was to evaluate the usefulness of the Mediterranean diet score (MDS) in detecting dietary change.

**Methods :** Subjects were Scottish patients who had survived an acute myocardial infarction, were attending cardiac rehabilitation and participating in a randomised-controlled study to examine the effectiveness of intensive dietary counselling. Seventy-five post-myocardial infarction patients were randomised to receive either usual care or intensive dietary counselling, of 4 hours duration, encouraging the consumption of a diet in accordance with the principles of the Mediterranean diet.

**Results :** At baseline and 12-weeks after the completion of cardiac rehabilitation all subjects completed 7-day weighed intake food diaries which were used to calculate the MDS at these time points. At baseline there was no difference between the groups either in the proportion of subjects achieving a high MDS ( $\geq 4$ ) or in the mean MDS. However, at 12 weeks a greater number of subjects in the intervention group achieved a high MDS compared with those in the control group (38% vs 16%,  $p=0.039$ ) and the mean MDS was significantly higher for the intervention group (3.24 vs 2.31,  $p < 0.000$ ).

**Conclusions :** The MDS has been used to compare the diets of groups but this study was the first to examine the value of the MDS to evaluate changes in eating habits following a dietary intervention. While the results of this study are promising, further research using the MDS as an evaluation measure is warranted before its widespread use for this purpose is recommended.

1. Trichopoulou A, Kouris-Blazos A, Wahlqvist M, et al. *British Medical Journal*, 1995. 311: 1457-1460.

**P22 THE INFLUENCE OF A MEDITERRANEAN-LIKE DIET WITH AND WITHOUT RED WINE ON THE CRITERIA RELATED TO THE METABOLIC SYNDROME***DP. Van Velden<sup>1</sup>, EPG. Mansvelt<sup>1</sup>, P. Wolmarans<sup>2</sup>, E. Fourie<sup>1</sup>, DG. Nel<sup>1</sup>, AD. Marais<sup>3</sup>, DM. Blackhurst<sup>3</sup>*

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**Introduction :** The metabolic syndrome is a cluster of cardiovascular risk factors linked to insulin resistance. There is evidence that life-style changes may prevent the expression of the insulin resistance phenotype. **Objective:** This study examined whether a Mediterranean-like diet supplemented with red wine had an impact on the criteria related to the metabolic syndrome.

**Materials and Methods :** In a cross-over study, 10 healthy men and 10 women between the ages 25 to 59 years, without severe dyslipidaemia and on no medication, consumed a Mediterranean-like diet for 6 weeks respectively with and without red wine. During the experimental periods the subjects increased their intake of vegetables, cereals, fruit, mono-unsaturated fatty acids and fish at the expense of red meats and dairy products. Dietary control was through 4 times 3-day dietary record during the study period. Fasting blood samples were taken at base line, after the diet and after the diet plus wine periods. Total cholesterol (TC), triglycerides (TG), HDLC, LDLC, and LDL particle size, insulin, glucose, uric acid, as well as the BMI and blood pressure were measured.

**Results :** The serum lipids, uric acid and insulin did not change significantly during the study, nor did the LDL particle size compared to baseline values. The blood pressure recordings also remained unchanged. The changes in the BMI ( $p= 0.0023$ ) and fasting glucose ( $p= 0.0435$ ) were significant as compared to the base line values. The addition of red wine to the Mediterranean-type diet did not significantly add to these beneficial changes.

**Conclusions :** The Mediterranean-like diet had a protective effect against the metabolic syndrome, and more specifically on the impaired glucose regulation by significantly lowering the fasting glucose level and BMI after the diet plus wine period. This study indicates that minor lifestyle changes can markedly influence the impaired response to the physiological effects of insulin including those on glucose and lipid metabolism.

**P23 TRADITIONAL FOODS : HEALTH, CULTURAL AND STANDARDIZATION ASPECTS***E. Vasilopoulou & A. Trichopoulou*

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**Introduction :** Nutritional investigations have provided strong support that a diet that adheres to the principles of the traditional Mediterranean one is associated with longer survival. This could be partly attributed to Mediterranean traditional foods, which this diet implies.

**Objective:** There is a need to study traditional foods in order to enrich and improve our diet and at the same time preserve important elements of our cultural inheritance. Our research team has implemented several research projects, with the objective to formulate a framework for the systematic investigation of traditional foods and recipes, aiming primarily at the elucidation of the role of traditional Greek diet on health.

**Methodology:** The study of traditional foods is multifaceted and includes:

- Determination of the nutrient and non-nutrient value of primary and composite traditional foods.
- Recording of the traditional production methods with audio-visual means.
- Technological study on their potential industrial or semi-industrial production.
- Formation of integrated records related to their traditional character, which may serve as identification files for potential use in proprietary claims.
- Historical and folkloric review, which documents their traditional identity.

**Results :** We present some highlights of traditional foods studied:

Pasteli (sesame bar): Compared to snacks with similar energy value, pasteli has a higher protein and dietary fiber content and in spite of its high proportion of lipids, cholesterol is absent and saturated lipids are low.

Green pies: In recipes, where the only added lipid was extra virgin olive oil, 55% of the food's energy value derived solely from olive oil. Moreover, edible greens provide significant amounts of antioxidants.

**Conclusions :** The study of traditional Greek foods provided evidence of their beneficial effects on health, indicating that they meet current criteria for a prudent diet. The registration and standardization of traditional foods could provide incentive for their reinstatement into the daily diet.

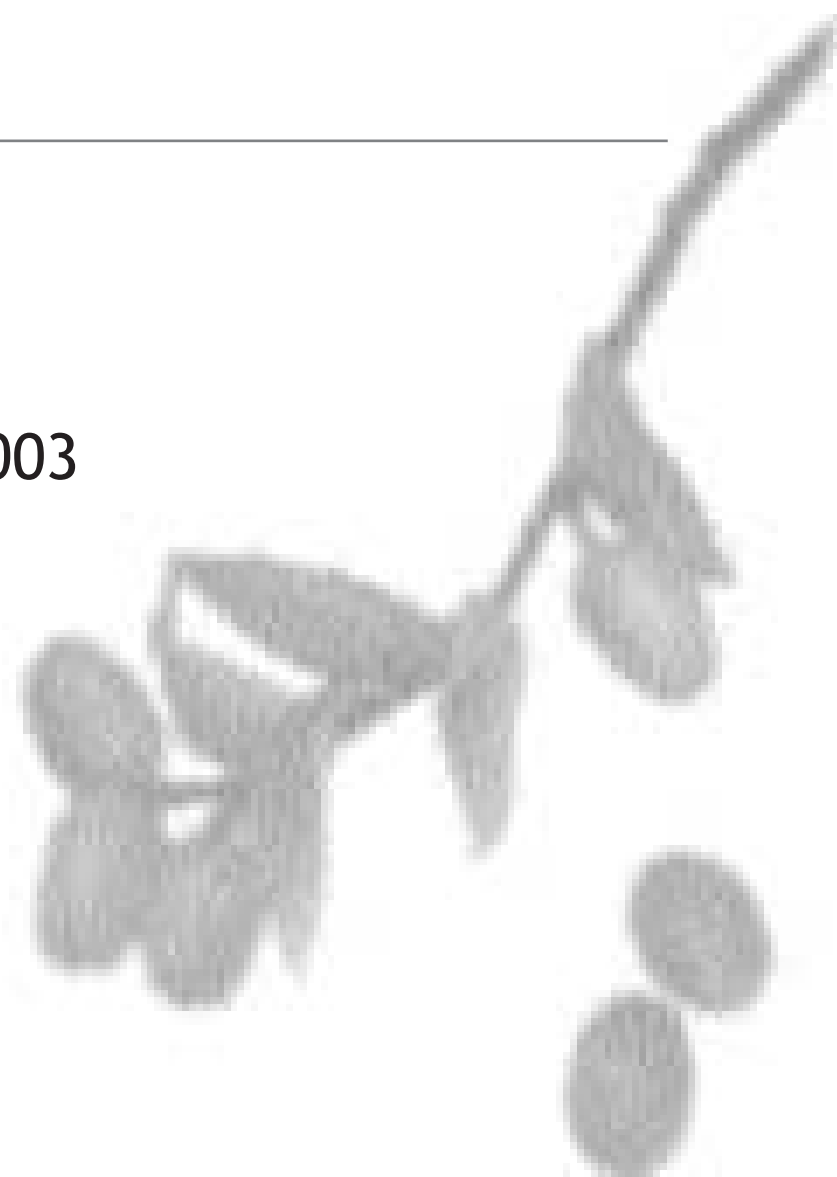


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# *POSTERS*

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Poster Session :  
Saturday, June 7<sup>th</sup>, 2003  
7:30 pm  
*Lida Conference Room*



## P24 INFLUENCE OF FISH PROTEIN ON BLOOD PRESSURE, PLASMA, LIPOPROTEIN METABOLISM AND ON HEPATIC ENZYME ACTIVITIES IN SPONTANEOUSLY HYPERTENSIVE RATS

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Hypertension is a major risk factor in the development of coronary heart disease, along with other factors as dyslipidemia, obesity and diabetes. It has been reconized that the incidence of cerebral stroke lesions was lowered, and lifespans were elongated by improving the protein source, even if this has no effect on blood pressure (Murakami et al., 1994). The aim of the study was designed to determine if dietary protein sources (casein and fish protein) are related to changes in blood pressure, lipoprotein metabolism and liver enzyme activities in spontaneously hypertensive rats at 5 wk of age.

Hydroxy-methyl-glutaryl Coenzyme A (HMG CoA)-reductase, cholesterol 7 $\alpha$ -hydroxylase, acyl-CoA :cholesterol O-acyltransferase (ACAT) activities were measured in liver.

After 2 mo of experiment, fish protein diet lowered blood pressure (-14%) and plasma angiotensin II concentration (-65%) compared to casein diet. Fish protein diet decreased the concentrations of triacylglycerol (TG), phospholipid (PL) and cholesteryl esters (CE) in liver. Plasma, liver and HDL2-total cholesterol contents were respectively, 1.25-, 1.71- and 1.79-fold lower in fish protein group than in casein group. Consumption of fish protein decreased HDL3 amounts and apolipoproteins, HDL2-PL, -unesterified cholesterol (UC) and -CE and VLDL-TG. Furthermore, fish protein reduced VLDL-apo B48 (-44%) and increased -apo C (+49%). HDL3-apo A-I, A-II and A-IV were respectively, 1.62-, 2.20- and 1.70-fold lower, whereas, apo A-II and A-IV of HDL2 were 3.44- and 1.71-fold higher in SHR fed fish protein than in those fed casein. As compared to casein, fish protein enhanced cholesterol 7 $\alpha$ -hydroxylase (+79%) and HMG CoA-reductase (+33%) activities but decreased (-39%) ACAT activity in liver. The 16 :0 was lower in VLDL-TG but higher in LDL-HDL1-CE in fish protein group. Total monounsaturated fatty acids, especially, 16 :1(n-7) and 18 :1(n-9) in VLDL-TG were lower in fish protein than in casein groups. The proportion of 18 :2(n-6) was 3.21-fold lower in HDL3-PL and 2.54-fold lower in LDL-HDL1-CE in fish protein fed rats. The proportion of 20 :4(n-6) in VLDL-TG, LDL-HDL1-CE and HDL3-PL was significantly lower in fish protein than in casein fed groups.

The results show that administration of fish protein to SHR has a favorable influence on blood pressure, plasma angiotensin II and cholesterol concentration as compared to casein. It stimulates HMG-CoA reductase and 7 $\alpha$  hydroxylase activities but has different effects on HDL2 and HDL3 lipid metabolism. This investigation reported a novel argument on the importance of fish protein in the prevention and the development of hypertension and its complications.

## P25 FRUITS AND VEGETABLES CONSUMPTION IN RELATION TO NUTRIENT INTAKES OF UNIVERSITY OF CRETE MEDICAL STUDENTS

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**Introduction :** Minerals, vitamins and micronutrients are essential to dietary metabolic balance and organ tissue development. Unfortunately, their intake is often inadequate especially among young adults. Fruits and vegetables are considered important providers of such nutrients. There are no studies, however, examining fruits and vegetables consumption in relation to nutrient intake of young adult groups in Greece.

**Objective:** To investigate the consumption of fruits and vegetables by Greek medical students and its association with daily nutrient intake.

**Materials and Methods :** A total of 523 third-year medical students (299 men, 224 women) aged 22  $\pm$  2 years were examined in the context of the Clinical Nutrition class of the University of Crete School of Medicine (UCSM). Trained nutritionists conducted a 24-h dietary recall to each participant, and anthropometric measurements were performed. Nutrient contents were analyzed according to the food database developed by the Nutrition Clinic of the UCSM.

**Results :** Ninety percent of the male and 94% of the female students reported consuming fruits and/or vegetables (defined as consumers in contrast to non-consumers who ate no fruits or vegetables), with a mean  $\pm$  SD intake of 327  $\pm$  273g/day and 358  $\pm$  285g/day respectively. The contribution of total fat to daily energy intake was 44.0  $\pm$  1.5% for non-consumers and 39.6  $\pm$  0.4% for consumers (p=0.005). Consumers had significantly higher intake of calcium (p<0.05), iron (p<0.05), magnesium (p<0.001), phosphorous (p<0.05), and potassium (p<0.001) than non-consumers. The consumption of fruits and vegetables was favourably related to the intake of vitamin C (p<0.001), A (p=0.002), B2 (p<0.05) and B6 (p=0.001). The dietary fibre intake was significantly higher among consumers (16.6  $\pm$  0.4g vs. 9.5  $\pm$  1.5g, p<0.001).

**Conclusions :** Fruits and vegetables consumption was strongly associated with the intake of essential micronutrients among Greek medical students and may therefore contribute to a well balanced diet.

**P26 THE BLOOD ETHANOL CURVE AFTER DRINKING RED OR WHITE WINE***I. Bitsch<sup>1</sup>, M. Netzel<sup>2</sup>, G. Strass<sup>1,2</sup>, T. Frank<sup>3</sup> & I. Bitsch<sup>2</sup>*<sup>1</sup>Institute of Nutrition, Justus-Liebig-University, Wilhelm Strasse 20, D-35392 Giessen, Germany<sup>2</sup>Institute of Nutrition, Friedrich-Schiller-University, Dornburger Strasse 29, D-07743 Jena, Germany<sup>3</sup>IMFORM GmbH, International Clinical Research, Birkenweg 14, D-64295 Darmstadt, Germany

**Introduction :** Gustafson and Källmen (1988) were the first who demonstrated that the general form of the blood ethanol curves are dependent on the consumed beverage. Comparing the curves of the same individuals drinking either beer or white wine (La Garonne) they found, that after beer the time to reach the maximal blood concentration was longer than after white wine and they postulated that this may result in different physiological effects. **Objective :** In our study we compared the concentration-time curves of ethanol in plasma of volunteers after drinking red or white wine.

**Materials and Methods :** 6 apparently healthy volunteers ingested after an overnight fasting either 400 ml red wine (Spätburgunder or Lemberger) or 400 ml white wine (Weissburgunder). The experimentals were carried out at a 4 weeks distance with the same subjects in a randomised cross-over design. Plasma was collected before and 15, 30, 60, 90, 120 and 180 min. after drinking. Ethanol concentration in plasma was estimated with clinical methods and a noncompartmental pharmacokinetic evaluation was performed according to standard methods using the WinNonlin® Professional Software. The following parameters were evaluated: tmax, cmax, AUC (0-3).

**Results :** The results of this pilot study are pointing to the fact that there are differences in the pharmacokinetics of ethanol depending on the ingested beverage. In our study there was a significant ( $p < 0.05$ ) difference in the time to reach maximal blood ethanol concentration (tmax) between the red wine Lemberger ( $0.792 \pm 0.332$  hr) and the white wine Weissburgunder ( $1.50 \pm 0.00$  hr). The total elimination time of ethanol after Lemberger was  $6.8 \pm 1.3$  hr and after Weissburgunder  $7.5 \pm 1.7$  hr.

**Conclusions :** Ethanol and alcohol beverages are known to affect upper gastrointestinal motility in humans. White wine has been reported to diminish gastric emptying compared to beer and there seems to be the same effect comparing the absorption rate of white wine with that of red wine.

**P27 EFFECTS OF GERMAN RED OR WHITE WINE DRINKING ON THE ANTIOXIDATIVE CAPACITY OF HUMAN PLASMA***R. Bitsch<sup>1</sup>, M. Netzel<sup>1</sup>, G. Strass<sup>1,2</sup>, T. Frank<sup>3</sup> & I. Bitsch<sup>2</sup>*<sup>1</sup> Institute of Nutrition, Friedrich-Schiller-University, Dornburger Strasse 29, D-07743 Jena, Germany<sup>2</sup>Institute of Nutrition, Justus-Liebig-University, Wilhelm Strasse 20, D-35392 Giessen, Germany<sup>3</sup>IMFORM GmbH, International Clinical Research, Birkenweg 14, D-64295 Darmstadt, Germany

**Introduction:** The cardioprotective effects of red wine consumption have been attributed to its high content of polyphenolic compounds. These substances are potent antioxidants capable of scavenging free radicals and inhibiting lipid peroxidation in vivo. In Germany, people mostly prefer white wines instead of red ones but white wines contain only small amounts of polyphenolic compounds. Therefore it is astonishing that recently several authors described cardioprotective effects resulting from white wine drinking in humans and animals.

**Objectives:** In the present study, the effect of an ingestion of red or white wine from German production on the total plasma antioxidant status and the profile and content of some selected polyphenols was determined in plasma of human volunteers.

**Material and Methods:** 6 apparently healthy volunteers ingested after an overnight fasting either 400 ml Spätburgunder or Lemberger or Weißburgunder or tap water (control) together with a standard meal. The experiments were carried over a 4 weeks period in a randomized cross-over design. Plasma was collected before and 15, 30, 60, 90, 120 and 180 min. after drinking. The total plasma antioxidant capacity was measured with 3 different methods (TEAC-test, TRAP-test, PCL-test).

**Results:** Both red wine and white wine drinking resulted in significant ( $p < 0.05$ ) increases of the initial antioxidative capacity of plasma. This plasmatic increase did not correspond neither to the antioxidant capacity of the wines nor to the total phenolic content nor to the concentration of selected polyphenols in plasma. White wine ingestion resulted in a greater rise of the antioxidant capacity when measured with the PCL- test and a lower rise when using the TRAP-test than the red wines.

**Conclusion:** The results document an enhancement of the antioxidative potential in human blood after drinking white wine which is not only induced by polyphenols.



**P28 DIETARY ALPHA-LINOLENIC ACID INTAKE, HEART DISEASE AND PROSTATE CANCER***IA. Brouwer, MB. Katan & PL. Zock*

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**Background and aim:** The protective effect of very-long chain n-3 fatty acids as present in fish on heart disease is well-documented. However, much less is known about the effect of alpha-linolenic acid (C18:3n-3), the n-3 fatty acid present in vegetable oil. We reviewed results of human studies on ALA intake and heart disease and addressed possible adverse effects on prostate cancer.

**Subjects and Methods:** We identified 5 prospective cohort studies that reported on the intake of ALA and endpoints of cardiovascular disease. We further reviewed data from clinical trials on ALA intake and cardiovascular disease. In addition, we identified 10 prospective cohort and case-control studies that reported ALA intake or levels and prostate cancer. We calculated combined risk estimates of disease by using a random-effects model.

**Results:** The combined relative risk estimate for fatal coronary heart disease, adjusted for other risk factors, is 0.79 (95% CI: 0.60-1.04) for a high versus a low intake. The average difference of ALA intake was 1.2 g/d. Results from three secondary trials also suggested that a high intake of ALA lowers the risk of coronary heart disease. Combined data from 10 observational studies show a relative risk of prostate cancer of 1.50 (0.99-2.28) for men with either a high intake or high blood levels of ALA. Results from different studies were heterogenous, without apparent reason.

**Conclusion:** Evidence from prospective cohort and clinical trials together suggests that ALA protects against fatal coronary heart disease. Observational studies suggest that ALA intake is associated with increased prostate cancer risk. This association may not be causal, and prostate cancer is 5-10 times less frequent than heart disease and occurs at an older age. Nevertheless, the association is too large to ignore, and the role of ALA in prostate cancer deserves further study.

**P29 INDICATORS OF OXIDATIVE STRESS IN ELDERLY MEN AGED 80 AND OVER : DIFFERENCES BETWEEN CRETE AND ZUTPHEN (NL)***B. Buijsse<sup>1,2</sup>, EM. Feskens<sup>1</sup>, EHJM. Jansen<sup>3</sup>, J. Moschandreas<sup>4</sup>, A. Kafatos<sup>4</sup> & D. Kromhout<sup>1,2</sup>*

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**Introduction :** Levels of circulating hydroperoxides and indicators of iron status are commonly used as markers for oxidative stress and high levels may increase coronary heart disease risk and decrease survival.

**Objective:** To evaluate potential differences in hydroperoxides, total serum iron, ferritin and non-transferrin-bound iron (NTBI) in sera of survivors of two cohorts of the Seven Countries Study, Crete and Zutphen (NL).

**Materials and methods:** For this cross-sectional analysis blood samples were collected between March and August 2000 from 147 men living in or near Zutphen and 128 men living on Crete, all aged 80 years or over. Sera were assayed for hydroperoxides, total serum iron, ferritin and NTBI in one laboratory. Analyses of covariance was used to calculate age-adjusted means and to test for significant differences between the cohorts and between smoking status within cohorts.

**Results :** The geometric mean level of serum hydroperoxides was significantly lower in men from Crete (34.2 mmol/L) compared to men from Zutphen (55.4 mmol/L) ( $p < 0.01$ ). Likewise, men from Crete had lower serum ferritin (65 mmol/L and 137 mmol/L, respectively) and iron levels (15.0 mmol/L and 17.7 mmol/L, respectively) (both  $p < 0.001$ ), whereas NTBI levels differed not significantly (0.63 mmol/L and 0.72 mmol/L, respectively) ( $p > 0.10$ ). In Zutphen, current smokers had significantly higher levels of serum iron compared to non-smokers ( $p < 0.05$ ). In Crete, no statistically significant differences in indicators of oxidative stress between smokers and non-smokers were observed.

**Conclusions :** Elderly men from Crete are exposed to less oxidative stress than elderly men from Zutphen as measured by serum hydroperoxides and serum iron and ferritin.



**P30 MEDITERRANEAN DIET AS A MODEL DIET IN PREVENTION AND TREATMENT OF CHD. GRAPHIC METHOD FOR DOCTORS TO EXPLAIN THIS DIET TO PATIENTS WITH CHD**

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**Introduction :** Eurodiet Report (2000) recommends creating national Food-based Dietary Guidelines.

**Objective:** 1. To design a graphic method for doctors to explain the principles of Mediterranean diet in CHD prevention and treatment to the patient. 2. Evaluation of consistency of nutrition value of designed model diets with Mediterranean diet and comparison of their vitamin and mineral content with RDI for females and males at various ages.

**Materials and Methods :** Polish Food Guide Pyramid and 10 Dietary Guidelines were used for graphic demonstration of the diet's principles. In the Pyramid food products were divided into 5 groups: cereals, vegetables, fruit, milk products, meat and its substitutes. An average measure of 1 serving was calculated. Additionally, vegetable fats and sweets were placed outside the Pyramid.

**Results 1. :** A table, graphically associated with the Pyramid, was designed. It shows the number of product servings from respective food groups for healthy nutrition of females and males at various ages. 2. An average nutrition value of model diets: protein ~16% E, fat <30% E, MUFA ~10% E, SFA ~7% E, cholesterol <200 mg, linolenic acid 2.2-2.6 g, EPA 150 mg, DHA 150 mg, n-6/n-3 < 3, fibre 25-40 g. Diets >1800 kcal supply vitamins and minerals on RDI level, diets of lower energy value may need supplementation.

**Conclusions :** This graphic method of explanation the principles of Mediterranean diet is well understandable by patients and helps them to follow diet prescribed by their doctor. Nutritional values of proposed diets are consistent with principles of the Mediterranean diet.

**P31 N-3 FATTY ACIDS AND MARKERS OF CARDIAC ARRHYTHMIA IN HEALTHY MIDDLE-AGED SUBJECTS**

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**Introduction:** N-3 fatty acids may reduce the risk of sudden death by preventing life-threatening cardiac arrhythmias. Two possible mechanisms are through an effect on cardiac autonomic regulation and through electrophysiologic effects on heart cell membranes. Heart rate variability (HRV) and baroreflex sensitivity (BRS) reflect cardiac autonomic regulation; reduced values predict arrhythmic events and mortality. Effects of n-3 fatty acids on these risk indicators of arrhythmia have not widely been studied. A standard electrocardiogram (ECG) may be used to detect clues as to the mechanism by which n-3 fatty acids affect the electrophysiology of the heart.

**Introduction:** To investigate the effect of supplemental intake of n-3 fatty acids on autonomic regulation and electrophysiology of the heart in apparently healthy subjects aged 50 to 70

**Materials and methods:** After a run-in period of 4 weeks, 84 subjects were randomized to receive capsules with either 3.5 g fish oil or placebo oil daily for 12 weeks. Before and after intervention, ECGs and blood pressure were recorded for 10 minutes with standardized respiration of 15 breaths per minute.

**Results:** HRV and BRS did not significantly improve by the intake of n-3 fatty acids. HRV decreased by 3.05 ms or 7.7% (95% confidence interval, -8.91 to 2.82 ms) and BRS decreased by 0.92 ms/mmHg or 0.1% (95% confidence interval, -2.66 to 0.81 ms/mmHg) in the fish oil group compared to the placebo group. ECG characteristics were hardly affected by n-3 fatty acids.

**Conclusions:** N-3 fatty acids have no substantial effect on indicators of autonomic regulation in healthy subjects. Also, these results can not support the hypothesis that (n-3) fatty acids prevent arrhythmia through electrophysiologic effects on heart cell membranes. Potential effects of n-3 fatty acids on autonomic regulation and electrophysiology of the heart should be studied in more susceptible populations.

**P32 STABILITY AND RADICAL SCAVENGING CAPACITY OF HEATED OLIVE OIL**G. Kalantzakis<sup>1</sup>, L. Parkányiová<sup>2</sup>, G. Blekas<sup>1</sup> & D. Boskou<sup>1</sup><sup>1</sup>Laboratory of Food Chemistry and Technology, Faculty of Chemistry, Aristotle University of Thessaloniki, Thessaloniki GR-54124, Greece.<sup>2</sup>Department. of Food Chemistry and Analysis, Institute of Chemical Technology, CZ-16628, Prague, Czech Republic.

**Introduction :** Virgin olive oil has a remarkable radical scavenging capacity. However, very little is known about the loss of this capacity, when the oil is used in domestic frying.

**Objective:** The objective of this study was to evaluate the stability of heated olive oil in relation to its radical scavenging capacity (RSC) and to compare these properties with those of other plant oils used in frying.

**Materials and Methods :** Oils (virgin and refined olive oil, refined sunflower, cottonseed and soybean oil and a commercial mixture special for frying) were purchased from the retail market or donated by a plant located in the area of Athens. The oils were heated at 180°C for 10 hours. RSC was measured spectrophotometrically using the 2,2-diphenyl-1-picrylhydrazyl radical. Results were expressed as Trolox equivalents. Polar compounds (PC) content was measured using the standard IUPAC method.

**Results :** Initial RSC values were practically similar for all the oils tested. Virgin and refined olive oil reached rejection point (27% PC) after prolonged heating (more than 10 hours), but they lost their RSC in 5 hours. Sunflower, cottonseed, soybean oils and the commercial frying mixture reached rejection point in a shorter period of heating in relation to virgin olive oil, but they retained longer their RSC.

**Conclusions :** It is clear from the results that a different evaluation is needed if the oil is seen only as a frying medium and a different one if the frying oil has to be also a source of natural antioxidants. Virgin olive oil, which is widely used as a salad oil, seems to retain its nutritional value if used in frying for a limited number of frying operations.

**P33 BIOACTIVE CONSTITUENTS FROM *Cichorium pumilum***

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**Introduction :** Leaves and roots of *Cichorium* species (*C. intybus* L., *C. endivia* L., *C. pumilum* Jacq., Asteraceae) have been not only used as a food supplement but also for medicinal purposes to promote appetite and digestion. The plants elaborate sesquiterpene lactones, including bitter lactucin-like guaianolides, as their characteristic secondary metabolites, some of which possess interesting biological activities. For example, the eudesmanolide magnolialide present in roots of the three above mentioned species and in leaves of some *C. intybus* cultivars appeared to induce differentiation of human leukemia cells to monocyte/macrophage cells [1].

**Objective:** Phytochemically, roots of *C. pumilum* have not been analysed in detail. To date only magnolialide and its derivative artesisin have been reported. Therefore, we decided to search for further secondary metabolites that might be present in the plant material.

**Materials and Methods :** The compounds were extracted with ethanol and separated from the extract using column and thin layer chromatographies on silica gel followed by semiprep. RP HPLC. They were identified by spectral comparison with reference compounds from our collection or with reported values.

**Results :** As well as re-isolating the two previously known root constituents, we were able to obtain two further closely related eudesmanolides along with eight lactucin-like guaianolides and five phenolics.

**Conclusions :** Roots of *C. pumilum*, *C. intybus* [2] and *C. endivia* [3] appear to be comparatively uniform in their sesquiterpene lactone compositions; six of the isolated compounds, i.e. magnolialide and the bitter lactucin-like guaianolides 8-deoxylactucin, lactucin, 11b,13-dihydroxylactucin, lactucopicrin and picriside B, are held in common.

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### P34 LIPOPROTEIN PROFILE AND PREVALENCE OF CARDIOVASCULAR RISK FACTORS IN AN URBAN WOMEN POPULATION OF EL JADIDA IN MOROCCO

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**Aim:** In Morocco, dietary habits are exclusively managed by the women, that is why we have to implicate them to touch all the population. The objective of the study was to determine the lipid and apolipoprotein profile, evaluate the prevalence of cardiovascular risk factors and their relationship to age in an urban adult women population of El jadida in Morocco.

**Design:** A total of 213 women, aged 25-55 were included in this study. All the women included were teachers or manual workers, which is representing the most important part of urban women in El jadida. Lipid and apolipoprotein profiles were studied including measurement of plasma triglycerides (TG), plasma cholesterol (TC), triglyceride-rich lipoprotein triglycerides (TRL-TG), TRL-cholesterol (TRL-C), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), apolipoproteins A1, B, B48, CIII and E. Body mass index (BMI) and blood pressure (BP) were assessed.

**Results:** The women studied showed the following pattern: elevated (over normal levels) TC and LDL-C levels in 10% and 19.4%, respectively; low HDL-C levels in 45.3%, elevated TG levels in 11.8%. Obesity (BMI > 30) and hypertension were highly prevalent ie in 23.9% and 16.5%, respectively. Elevated TRL-C level (> 0.6 mmol/l) was present in 13.4% and elevated TRL-TG level (> 0.8 mmol/l) was present in 13.4%. Plasma triglyceride concentrations were closely correlated with plasma TRL-TG (R=0.86, P=0.0001), apoB (R=0.50, P=0.0001) and apoCIII (R=0.52, P=0.0001) concentrations and moderately correlated with HDL-C levels (R=-0.3, P=0.0001) and BMI (R=0.4, P=0.0001). The association between BMI and systolic blood pressure was statistically significant (R=0.3, P=0.0001). Obesity, BP, TRL-C, TRL-TG, TG, apoB and apoCIII significantly increased with age.

**Conclusion:** High prevalence of some risk factors for cardiovascular disease including altered lipid and lipoprotein profiles was found in the Morocco urban women population studied. In addition, we found important associations between age, especially above 35 y, and some risk factors. This suggests that such Mediterranean populations are at high risk for cardiovascular disease and that dietary interventions should take an important place in prevention strategy.

### P35 IS OMEGA-3 PUFA OF BENEFIT FOR MEDITERRANEAN PATIENTS WITH CORONARY ARTERY DISEASE ?

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**Introduction :** A low frequency of ischaemic heart diseases in Eskimos has been related to polyunsaturated fatty acids.

**Objective:** To investigate the consumption of fruits and vegetables by Greek medical students and its association with daily nutrient intake.

**Objective:** To examine fatty acid patterns associated with coronary artery disease (CAD) for a possible relationship between fatty acid profile and CAD diagnosis in Mediterranean patients

**Methods:** A total of 50 consecutive patients were included. The gas chromatography method was used to analyze the membranes of erythrocytes from patients. The patients without coronary stenosis were used as controls (n=24).

**Results :** Patients with CAD (n =26) showed increased percentages of saturated fatty acids (35.8 vs. 34.2%, p<0.001) and monounsaturated fatty acids (14.6 vs. 13.6 %, p<0.01), as well as reduced percentages of polyunsaturated fatty acids (38.5 vs. 41.3% P<0.001). The decrease in polyunsaturated fatty acids percentages was due to the series of n-3 fatty acids (9.2 vs. 11.4 %, p<0.001) and docosapentaenoic acid (C22 :5(n-3)) (2.99 vs. 3.94%, p<0.001), mainly at the expense of docosahexaenoic acid (C22:6 (n-3)) (4.92 % vs. 6.41 %, p<0.001). The study shows altered n-3 fatty acids in Mediterranean patients with CAD. Our data suggest that the percentage of docosahexaenoic and docosapentaenoic acids in erythrocytes could be used as indicators of an independent risk factor for coronary artery disease.

**Conclusions :** Fatty acid dietary interventions could be of benefit for mediterranean patients with CAD.

**P36 OMEGACOEUR®, A MEDITERRANEAN NUTRITIONAL COMPLEMENT, INHIBITS MONOCYTE ADHESION TO HUMAN ENDOTHELIAL CELLS**

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**Introduction :** Mediterranean diet is known to protect from cardiovascular diseases. The Mediterranean nutritional complement Omegacoeur® (Laboratoire Holistica International, France) consists of a mixture of different natural oils enriched in w3, w6 and w9 fatty acids. Objective :As w3 polyunsaturated fatty acids exhibit anti-inflammatory properties, we evaluated the effect of Omegacoeur® on monocyte adhesion to endothelial cells.

**Materials and Methods :** Monocyte adhesion was induced by exposing human endothelial cells to TNF (tumor necrosis factor, 50 ng/ml). Endothelial cells were incubated with either standard culture medium, TNF alone or TNF + Omegacoeur® for 24h. For the adhesion assay, the amount of fluorescent monocytes attached to the endothelium was measured using a fluorimeter.

**Results :** Exposure of human endothelial cells to TNF increased monocyte adhesion by 37%. The use of Omegacoeur® decreased the TNF-induced monocyte adhesion (-13%).

**Conclusions :** Omegacoeur is able to antagonize monocyte adhesion to TNF-stimulated endothelial cells and may be effective in preventing or treating cardiovascular diseases.

**P37 VEGETABLE CONSUMPTION (DAUCUS CAROTTA AND LACTUCA SATIVA) IMPROVES CHOLESTEROL METABOLISM AND ANTIOXIDANT STATUS IN ANIMALS FED CHOLESTEROL ENRICHED DIET**

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**Introduction :** Epidemiological studies have shown that a high consumption of fruits and vegetables is associated with a decreased risk of cardiovascular diseases, hypertension and cancers. Vegetables are a rich source of fiber, which can modulate cholesterol metabolism, other antioxidant compounds (vitamins, carotenoids and polyphenols) and minerals.

**Objective:** We investigated the effect of vegetable, focusing on lettuce and carrot consumption, on biomarkers of risk for cardiovascular diseases. Vegetables are a rich source of dietary antioxidants which may be implicated in the prevention of risk factors development. Risk factors include high blood pressure, high serum cholesterol or LDL-cholesterol.

**Materials and Methods :** Different animal models (Wistar, C57BL/6J mice or SHR) were fed either a control diet or a vegetable enriched diet (20% of dry weight) for 4 weeks (8 weeks for SHR). Besides lipemia and cholesterol metabolism parameters, we evaluated the plasma and urine levels of malondialdehydes and isoprostanes as markers of oxidative stress.

**Results :** In all models, apparent absorption of cholesterol decreased leading to lower total plasma cholesterol and triglyceride concentrations in animals fed vegetable diet, especially when dietary cholesterol was added to the diet. Lettuce also induced a decrease of cholesterol content in low density lipoproteins. Antioxidant status was improved in mice fed carrot diet as shown by FRAP, vitamin E, carotenoids, vitamin E/TG ratio measurements. In SHR rat, we observed a reduction of lipid peroxidation in lipoproteins (LDL) when fed carrot diet. Vegetable consumption influences other biomarkers of oxidative stress: we observed a decrease of TBARS and isoprostane urinary excretion or a decrease of peroxidability of heart tissue in rats fed lettuce diet.

**Conclusions :** The daily consumption of vegetable has hypolipemic effects and improves antioxidant status. The complex and multifunctional effects of vegetables can contribute to several benefits impacts on human health, not only on cardiovascular diseases but also on oxidative pathologies including some cancer and osteoporosis.



**P38 BLOOD PRESSURE AND HYPERTENSION IN THE GREEK POPULATION IN RELATION TO DIET :  
A STUDY OF 28000 ADULTS ACROSS THE COUNTRY**

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**Introduction :** Hypertension is responsible for a substantial fraction of cases of cardiovascular diseases, particularly stroke. From a public health perspective, hypertension ranks together with smoking, obesity, physical inactivity and inappropriate diet as principal targets. Hypertension may be particularly important for Greece since mortality from stroke in this country far exceeds the European average.

**Objective:** To identify predictors of systolic and diastolic blood pressure, as well as hypertension.

**Subjects & Methods:** Data at enrolment concerning blood pressure and possible sociodemographic and dietary determinants were retrieved for over 28000 Greek adults who participate in the Greek component of the European prospective investigation EPIC. Two approaches were used in the analysis: multiple regression of blood pressure (alternatively systolic and diastolic) among individuals not on anti-hypertensive treatment on a series of possible predictors; and multiple logistic regression contrasting hypertensives to non-hypertensives on the basis on the indicated possible predictors.

**Results :** The prevalence of hypertension is high in Greece and increases with age. The findings from the alternative analysis converge in indicating that predictors of high blood pressure or hypertension are: older age, low socio-economic status, rural residence, high body mass index, high waist to hip ratio, and low consumption of plant foods.

**Conclusions :** From a public health perspective, control of hypertension is as important for the Greek population as control of tobacco smoking and obesity. The beneficial role of high intake of plant foods underscores the importance of the traditional Mediterranean diet.

**P39 FLAVONOLS AND FLAVONES IN BULGARIAN VEGETABLES AND FRUITS**

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**Introduction :** Multiple scientific surveys prove the preventive role of Mediterranean diet against the development of modern diseases. This fact could easily be explained with the abundance of bioactive components contained in it, represented mainly by flavonoids. They appeared on the scientific nutrition scene after the French Paradox was unveiled. It turned out that the foods typical for Mediterranean and Balkan diets are a rich source of flavonoids. The knowledge on their diverse range is of great importance for the assessment of foods and nutrition.

**The aim** of the study is to determine flavonols and flavones in vegetables and fruits, typical for Balkan Diet, and to assess their intake in Bulgarian nutritional habits.

**Materials and Methods :** Flavonols myricetin, quercetin, kaempferol, and flavones luteolin and apigenin were determined in 25 vegetables belonging to 7 different plant families and in 17 fruits belonging to 3 families. The food samples were collected within the period 2001-2002, according the requirements for a representative sample (origin, variety, season, and quantity). Flavones and flavonols were determined as aglycones after acid hydrolysis of freeze-dried food material, using an RP-HPLC method with UV detection.

The dietary intake of analyzed flavonoids was determined on the basis on Household Budget Surveys food data.

**Results :** In vegetables the highest flavonols contents were determined in red onion (538.0 mg/kg), followed by lettuce (169.7 mg/kg) and green pepper "Kapia" (117.8 mg/kg). Among the fruits the flavonols reach their maximum value in blueberry (144.1 mg/kg), share out for myricetin (43.4 mg/kg) and quercetin (100.9 mg/kg). Relatively high is their level in apricot (30.4 mg/kg), blackberry (30.5 mg/kg), and strawberry (25.1 mg/kg). Flavones show high values in parsley (708.0 mg/kg) and in celery leaves (325.4 mg/kg) and celery roots (48.0 mg/kg). The results for dietary intake of flavons and flavonols in Bulgaria show that the highest intake is from onion, followed by pepper, apples, tomatoes, grape, and pears - 5.5, 1.9, 1.5, 0.7, 0.2, 0.1 mg/day/person, respectively.

**Conclusions :** The presented results will enrich the database with values for flavonols and flavones content in foods typical for Mediterranean and Balkan diet. The possibilities for assessment of the food intake and for exchange of near information related to nutritive as well as biologically active role of the food will be enhanced.

#### P40 QUANTITATION OF OLIVE OIL BIOACTIVE COMPONENTS IN GREEK CULTIVARS; METHOD DEVELOPMENT FOR THEIR DETERMINATION IN BIOLOGICAL FLUIDS

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##### Introduction

The olive oil, principal ingredient of the Mediterranean diet, contains a number of highly active metabolites such as oleuropein (OE), hydroxytyrosol (HT), tyrosol (T), elenolic acid (EA). These substances have been shown to possess antioxidant, anticancer, antibacterial and antiatherogenic properties. Therefore, the determination, as well as the bioavailability of the aforementioned substances is of vital importance.

##### Experimental

**Quantitation of HT, T, OE and EA in various Greek cultivars:** Weighted dried leaves from various Greek cultivars of *Olea europea* were extracted using various solvents. The extracts, after appropriate dilutions, were analyzed by a validated HPLC-DAD methodology for the quantitative determination of OE, HT, T and EA.

**Bioavailability studies of OE, T, HT and EA:** OE and olive oil has been administered to rats for a six-month period and the total amount present in their biological fluids was assessed. The sample pretreatment was based on an SPE method using OASIS HLB cartridges. The identification and quantitation of the analytes (HT, T and EA from rat urine and plasma) was carried out by a validated HPLC-DAD methodology on a C8 column using gradient elution. An increased sensitivity GC-MS/MS MRM quantitative method was also developed, where the analytes were converted to their corresponding trimethylsilyl ethers prior to the analysis.

##### Results and discussion

. There is a significant variation of the bioactive substances content in the various Greek *Olea europea* cultivars and therefore careful selection must be done in order to achieve the highest human health benefits.  
 . The methodologies developed for the bioanalytical studies have been shown to be accurate, precise and sensitive enough for the determination of the aforementioned analytes in biological fluids. Moreover initial results obtained show that HT and T are excreted in rat urine. Further LC-ESI-MS/MS research is underway to improve the sensitivity and specificity of the analysis.

#### P41 APPLE POLYPHENOLS INHIBIT SECRETION OF INTESTINAL TRIGLYCERIDE-RICH LIPOPROTEIN

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**Introduction :** Several epidemiological studies have suggested an association between a diet rich in fruits and vegetables and a lowered risk of cardiovascular diseases (CVD). Polyphenols contained in fruit and vegetables are reported to be protective against CVD, possibly through the modulation of the lipid metabolism, e.g. inhibition of lipoproteins oxidation or hepatic cholesterol synthesis. Furthermore, consumption of three apples per day has shown to decrease hyperlipemia. More recently, post-prandial hypertriglyceridemia, which depends partly on intestinal lipoprotein secretion, has been proposed as a major risk factor of CVD.

**Objective:** We therefore hypothesised that apple polyphenols could control intestinal triglyceride-rich lipoprotein (TRLP) synthesis and secretion.

**Materials and Methods :** Using human intestinal Caco-2/TC7 cells cultured on a microporous filter, we analysed the effect of apple-polyphenol addition on lipid absorption and TRLP secretion under an apical supply of complex lipid micelles, the composition of which mimicked that of post-prandial duodenal micelles.

**Results :** We showed that polyphenols inhibit the secretion of TRLP in a dose-dependent manner without any modification of fatty acid and cholesterol absorption and of triglyceride and phospholipid intracellular levels. In contrast, intracellular and secreted cholesteryl-esters were decreased by 32% and 58% respectively in the presence of 200 µg/ml of total apple-polyphenols extract, suggesting that polyphenols inhibit acyl-CoA cholesterol acyltransferase (ACAT) activity. In order to characterise which components could mediate the blockade of secretion, total apple polyphenols extract were fractionated by HPLC. Only the procyanidin-enriched fraction was able to inhibit TRLP secretion. Moreover, using CP-113818, an ACAT inhibitor, we were able to mimic the effect of apple polyphenols.

**Conclusions :** Together, these results suggest that apple procyanidins are responsible for the observed inhibition of TRLP by a mechanism which could implicate ACAT activity.

**P42 BENEFICIAL CHANGES IN CHD RISK FACTORS IN SUBJECTS ON A MEDITERRANEAN DIET FOR 3 MONTHS:  
THE MEDI-RIVAGE STUDY**

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**Aim:** The Medi-RIVAGE study is a dietary intervention where we randomly study a Mediterranean-type diet (MED : plenty of vegetable food and fish; 35% fat with half as monounsaturated) and the usual low fat prescribed diet (AHA-type : 30% fat, one third as monounsaturated), derived from the American Heart Association recommendations, in 212 volunteers who already have one or more cardiovascular risk factors for coronary heart disease (CHD). From the Seven Countries Study, the Framingham study and others numerous ones, risk factors for CHD have been identified. In this poster, we investigate the change in main CHD risk factors in the 88 subjects of the Medi-RIVAGE study which chronically ingested the Mediterranean diet for 3 months.

**Design:** The subjects, men or women, are included with at least one cardiovascular risk such as high plasma cholesterol or triglycerides level, BMI>27 kg/m<sup>2</sup>, cigarette smoking, etc... 212 subjects have been enrolled, and their new dietary habits are maintained for 3, then 12 months. The benefits of the diet are estimated by clinical evaluation, fasting biochemical parameters quantification and investigation of postprandial lipid metabolism.

**Results :** Comparison of subjects with defined risk factors at inclusion and after intervention with the Mediterranean diet for 3 months shows the following significant changes ( $p<0.05$  t-test for paired samples): Body Mass Index (BMI) 28.7 kg/m<sup>2</sup> at enrolment vs 27.7 kg/m<sup>2</sup> after 3 months (55.7% above 27 kg/m<sup>2</sup> at enrolment vs 46% after 3 months); fasting total blood cholesterol 6.6 mmol/l vs 6.1 mmol/l (53.4% above 6.6 mmol/l vs 33.3%); fasting LDL blood cholesterol 4.4 mmol/l vs 3.9 mmol/l (58.9% above 4.1 mmol/l vs 32.2%); fasting blood triglycerides 1.6 mmol/l vs 1.5 mmol/l (20.5% above 2.0 mmol/l vs 13.6%); fasting blood insulin 10.5  $\mu$ U/ml vs 8.3  $\mu$ U/ml (31.8% above 12  $\mu$ U/ml vs 12.0%); fasting blood glycemia 5.3 mmol/l vs 5.1 mmol/l (14.8% above 6.1 mmol/l vs 6.9%). No significant change in fasting HDL cholesterol was observed 1.5 mmol/l vs 1.5 mmol/l (36.4% below 1.3 mmol/l vs 38.6% after 3 months).

**Conclusions :** After 3 months diet, the Mediterranean diet significantly reduces the risk to develop CHD by decreasing numerous risk factors for the disease.





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**SEB**

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