Modification of Dietary Habits (Mediterranean Diet) and Cancer Mortality in a Southern Italian Village from 1960 to 1996

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INTRODUCTION

The principal source of information about dietary intake in Italy, in the 1960s, was the survey carried out by the European Atomic Energy Commission. Another source was the Seven Countries Study; therefore the data will only be used to make a rough comparison between Italy and other Mediterranean countries.[1] A more recent study was carried out as a longitudinal study, called the Seven Countries Study.[2–7]

For most types of cancer, genetic factors play only a minor role, as shown by the fact that in populations where the incidence of cancer runs from high to low, depending on the region, cancer incidence has increased in the last few decades. Indeed, environmental factors play a key role: when population studies are performed in developed and underdeveloped countries, the colorectal cancer age-adjusted incidence rate varies by a factor as high as 15-fold.[8–11] According to these studies, the lowest reported cancer rate in a worldwide study should be considered the baseline rate of occurrence, and the increases in rate should be ascribed to such environmental factors as pollution and diet. There is increasing evidence of an association between diet and morbidity or mortality from cancer and coronary heart disease, the two major age-related diseases of Western societies.

The "Mediterranean" effect on mortality is still evident in Italy, where food patterns differ significantly in different geographical areas. In fact there are differences in incidence of cancer between the north and south of Italy (i.e., mortality incidence of gut cancer is 0.363 in northern Italian regions and 0.115 in southern regions; for breast cancer mortality it is 0.264 in the North and 0.089 in the South). Slight differences may be found among Mediterranean countries, according to tradition, local production of food, and even religion: wine is largely consumed in Italy, Spain, and Greece, whereas it is forbidden in Muslim North Africa and Middle East.

The Mediterranean diet is a low-fat, high-carbohydrate, and fiber-rich diet, close to the traditional diet of Mediterranean countries; the diet is rich in cereal products,

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starch, vegetables and fruits, olive oil, and fish.[1,12] Cereals and olive oil were the major sources of energy in the ancient Mediterranean: during the Peloponnesian Wars, the rowers of an Athens trireme had to perform for an extended time in a dramatic situation. Their diet during this performance was mostly bread with olive oil, the best choice in their situation (Thucydides). Bread and olive oil were still common as an afternoon snack in southern Italy 50 years ago.

For people on the Mediterranean diet, according to southern Italian tradition (villages in Campania, Basilicata, and Calabria, 1960),[1] carbohydrates accounted for 60% of calories, fat (95% olive oil) for 28%, and proteins for 12 percent. A large supply of vitamins (A, C, and E) and minerals were obtained from fruits and vegetables, and daily fiber intake was between 20 and 35 g/day.

A low-fat, high-fiber diet is now highly recommended in Western countries,[13] as this diet should reduce the prevalence of atherosclerosis and some types of cancer, as suggested by several epidemiological studies worldwide.[8,14] Although the effects of a saturated fat-rich diet on serum cholesterol level were already known the in mid-1960s, the favorable effect of olive oil on lipoprotein profile has only been recognized in the last decade, as well as the protective effects of n-3 fatty acids. More recently, the preventive effect of antioxidant vitamins and bioflavonoids, largely supplied in the Mediterranean diet, have been outlined. Olive oil, rich in tyrosol, a powerful antioxidant bioflavonoid, seems very useful in the prevention of LDL oxidation. The antioxidant compounds, abundant in the Mediterranean diet, also have a protective effect against cancers (colon, breast, and prostate), in association with low-fat and low-caloric intake, and with a high-fiber intake.[15]

There are modifications in southern Italy related to a change in Italian lifestyle from a rural model toward a developed-country model (including also dietary habits), with a relevant increase of global income. In southern Italy the lifestyle modifications were more relevant, as northern Italy was already a fairly developed area, with dietary habits closer to the central European models. In Calabria, (a rural region, without large cities and with the population living mostly in villages or small towns) in the last two decades, a progressive shift from a low-fat, high-fiber, Mediterranean diet toward a Western-style diet has been shown by the modifications of average intakes of pasta, bread, and meat, evaluated by total expenditure per year (accounting for inflation).

The aim of the present study was to investigate the relationship, if any, between diet and cancer incidence rates in Calabria and to compare the food intake in Nicotera (a small town), as assessed in 1990,[16] to the food intake assessed in 1996 in the same village.

METHODS AND SUBJECTS

In 1996, 80 Nicotera subjects, 37 females and 43 males, 40 to 60 years old, were studied. Nicotera was a town in the Seven Countries Study. The food intake of the 1996 study participants was assessed by a semiquantitative questionnaire of food frequency, using the "Questionario di frequenza dei consumi alimentari," (food frequency consumption questionnaire), proposed and validated for the Italian population.[17] The foods most common in Italy were depicted in colored pictures (61

different foods), each of them in three different-sized servings, and the frequency of consumption was reported by the participants, in a range between "each day" and "six times a month" (self-administered questionnaire). For the 1960 food intake of Nicotera, a sample was calculated from the results of Fidanza's papers.[12] A descriptive analysis and plot were performed using an SPSS/PC for Windows program.

From 1974 to 1996, the total consumption of pasta and bread (evaluated cumulatively), and meat (total meat consumption and bovine meat only) were evaluated from total expenditure per year (accounting for inflation). Mortality rates for cancers at different sites (colon, breast, and pancreas) were recorded and expressed as deaths per year per 10^{11} inhabitants (interpolated data, FIG. 2). The autoregression trend (AMIRA) between the consumption rates and the rates of mortality for the cancers on study was performed, using an SPSS/PC for Windows program.

RESULTS

In FIGURE 1 daily intake values of nutrients for the 1960 and 1996 samples are reported: the values for carbohydrates, proteins, and total lipids. Total protein and lipid values were also divided into animal and vegetable ones. In 1996 the total ca-

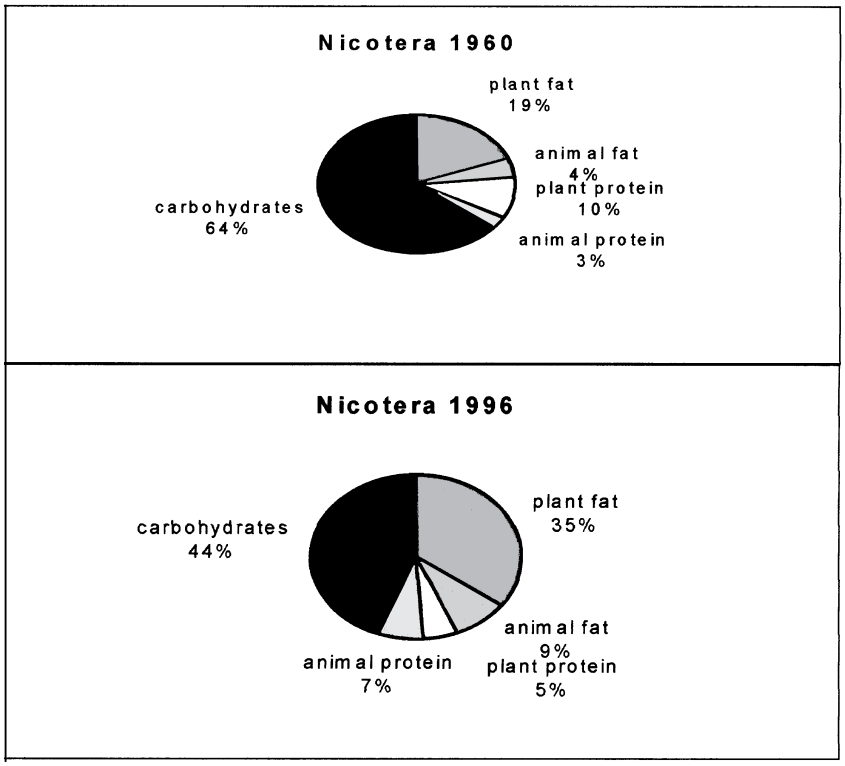

FIGURE 1. Comparison of nutrient percentages between the two samples.

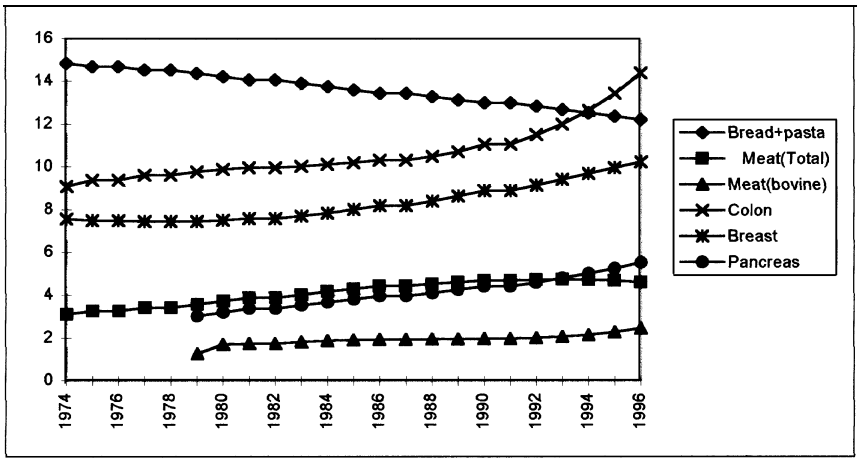

FIGURE 2. Consumption $\times 10^{11}$ kg/year and cancer mortality/10^{11}. Interpolated data.

loric intake was 2600 kcal/day: 1149 kcal from carbohydrates (44.2%), 317 kcal (12.2%) from proteins, and 1133 kcal from lipids (43.6%). Furthermore, cholesterol, fiber, and alcohol were analyzed. Calories from alcohol (287 kcal/day) were not included in the total caloric intake, but cholesterol and fiber values are lacking, because their calculation from available data (Fidanza's tables) was impossible. In 1960 the total caloric intake was 2144 kcal, 64.1% from carbohydrates, 12% from proteins, and 23.3% from lipids, a diet very close to the Mediterranean tradition.[1]

In the Nicotera 1960 sample, the diet was very close to the Italian Mediterranean diet, whereas an excess intake of lipids was found in the 1996 sample, and the carbohydrate intake was lower than the recommended dietary allowance.

From 1974 to 1996 the consumption of bread and pasta fell from 150.4×10^{11} (kg per year) to 125.9×10^{11}, whereas meat consumption (evaluated cumulatively) rose from 31.8×10^{11} to 48.8×10^{11}. From 1974 to 1996 bovine meat consumption increased from 13.3×10^{11} to 22.6×10^{11}. In the same years, the incidence of colon, breast, and pancreatic cancer mortality increased.

For the colon cancer mortality rate, a strong negative correlation (linear correlation: $r = 0.91613$) with bread and pasta consumption was observed; a weak positive correlation ($r = 0.73875$) with meat intake was observed. For the breast cancer mortality rate, a strong negative correlation ($r = 0.9544$) with bread and pasta consumption and positive correlation with meat consumption ($r = 0.81715$) were observed. For the pancreatic cancer mortality rate, a significant positive correlation with meat intake was observed ($r = 0.8761$), as well as a strong positive correlation with bovine meat consumption ($r = 0.9255$) (FIG. 2).

CONCLUSION

The results obtained in our study on food intake in Nicotera in 1996 are very close to the results obtained in a food consumption survey on the Italian population in

1991.[18] Thus, whereas in 1960 inhabitants of Nicotera followed a "reference Mediterranean Italian diet," [1,11] in 1996 the Nicotera diet was very close to the average Italian diet, which is no longer a Mediterranean diet, because of a striking increase in the use of animal products, like meat, milk, dairy products, animal fat, with a net decrease of bread and pasta consumption. According to our study, in Nicotera in almost 40 years, the lipid intake was increased to 43.6% of calories, whereas the carbohydrate intake was decreased to 44.2 percent. The protein intake was almost unmodified, but meat proteins are preferred today. The total caloric intake was increased by 20%, when physical activity was decreased (data not showed). As expected, many people were overweight (data not showed). The same trend was observed in most Mediterranean countries, suggesting that the Mediterranean diet should be adopted, especially in southern Italy and in most developed Mediterranean areas.[11,15] The most relevant finding is a strong negative correlation between bread and pasta consumption and colon and breast cancer mortality, never reported before.

Modifications to dietary habits may increase the risk of cancer in the general population: in our study, a close relationship was demonstrated between the modifications of food consumption patterns and cancer mortality at different sites (colon, breast, and pancreas). Calabrian people gave up the safe Mediterranean diet to adopt the less safe Western diet, with an increase of cancer risk, whereas in western developed countries an increase in the consumption of starch, and fresh fruits and vegetables (which are the main components of the Mediterranean diet) is being ever more strongly advised, with a proportionate diminution in meat and animal fat consumption. Therefore, these dietary trends in Calabria should be rapidly reversed. Future intervention to improve the health and nutritional status of our nation's children and adults and a return to the Mediterranean diet are culturally appropriate; changes need to be implemented at the individual, family, and community levels.

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