

Source: *Journal of Teratology*, Vol. 59, No. 6, June 1999

CAUSES OF COLON CANCER: COMPILATION OF 24 STUDIES

Based on National Library of Medicine database Compiled by Omega Fields (with commentary by Paul Stitt)

1 : *Am J Epidemiol* 1999 Oct 15;150(8):869-77

Lifestyle and colon cancer: an assessment of factors associated with risk. Slattery ML, Edwards SL, Boucher KM, Anderson K, Caan BJ University of Utah, Department of Family and Preventive Medicine, Health Research Center, Salt Lake City 84108, USA.

Studies of the etiology of colon cancer indicate that it is strongly associated with diet and lifestyle factors. The authors use data from a population-based study conducted in northern California, Utah, and Minnesota in 1991-1995 to determine lifestyle patterns and their association with colon cancer. Data obtained from 1,993 cases and 2,410 controls were grouped by using factor analyses to describe various aspects of lifestyle patterns. The first five lifestyle patterns for both men and women loaded heavily on dietary variables and were labeled: "Western," "moderation," "calcium/low-fat dairy;" "meat and mutagens," and "nibblers, smoking, and coffee." Other important lifestyle patterns that emerged were labeled "body size," "medication and supplementation," "alcohol," and "physical activity." Among both men and women, the lifestyle characterized by high levels of physical activity was the most marked lifestyle associated with colon cancer (odds ratios = 0.42, 95% confidence interval: 0.32, 0.55 and odds ratio = 0.52, 95% confidence interval: 0.39, 0.69, for men and women, respectively) followed by medication and supplementation (odds ratio = 1.68, 95% confidence interval: 1.29, 2.18 and odds ratio = 1.63, 95% CI 1.23, 2.16, respectively). Other lifestyles that were associated with colon cancer were the Western lifestyle, the lifestyle characterized by large body size, and the one characterized by calcium and low-fat dairy. Different lifestyle patterns appear to have age- and tumor site-specific associations.

Commentary: High calcium diet, lowfat dairy products and "Western Lifestyle" are associated with higher rates of colon cancer. P. S.

2 : *J Epidemiol* 1999 Aug;9(4):275-84

Factor analysis of digestive cancer mortality and food consumption in 65 Chinese counties.

Zhuo XG, Watanabe S Department of Nutritional Science, Faculty of Applied Bioscience, Tokyo University of Agriculture, Japan.

Dietary factors were analyzed for the regional difference of GI tract cancer mortality rates in China. Sixty-five rural counties were selected among a total of 2,392 counties to represent a range of rates for seven most prevalent cancers. The dietary data in the selected 65 counties were obtained by three-day dietary record of households in 1983. The four digestive cancer mortality rates (annual cases per 100,000 standardized truncated rates for ages 35-64) and per capita food consumption were analyzed by the principal components factor analysis. Esophageal cancer associated with poor area, dietary pattern rich in starchy tubers, and salt, lack of consumption of meat, eggs, vegetables and rice. Stomach cancer seemed to be less associated with diet in this study

because of its small model Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, suggesting some other carcinogenic factors would play more important role in the development of this cancer in China. The colon and rectal cancer showed close relation to diet; rich in sea vegetables, eggs, soy sauce, meat and fish, while lack in consumption of milk and dairy products. Rapeseed oil was more important risk factor for colon cancer than that of rectum. Rice, processed starch and sugar were closely associated with colon cancer, supporting the insulin/colon cancer hypothesis.

Commentary: Processed foods and sugar up cancer rates, even in China. P. S.

3 : Am J Clin Nutr 1999 Sep;70(3Suppl):532S-538S

Associations between diet and cancer, ischemic heart disease, and all-cause mortality in non-Hispanic white California Seventh-day Adventists.

Fraser GE Center for Health Research and the Department of Epidemiology and Biostatistics, Loma Linda University, CA 92350, USA. gfraser@sph.llu.edu

Results associating diet with chronic disease in a cohort of 34192 California Seventh-day Adventists are summarized. Most Seventh-day Adventists do not smoke cigarettes or drink alcohol, and there is a wide range of dietary exposures within the population. About 50% of those studied ate meat products <1 time/wk or not at all, and vegetarians consumed more tomatoes, legumes, nuts, and fruit, but less coffee, doughnuts, and eggs than did nonvegetarians. Multivariate analyses showed significant associations between beef consumption and fatal ischemic heart disease (IHD) in men [relative risk (RR) = 2.31 for subjects who ate beef > or =3 times/wk compared with vegetarians], significant protective associations between nut consumption and fatal and nonfatal IHD in both sexes (RR approximately 0.5 for subjects who ate nuts > or =5 times/wk compared with those who ate nuts <1 time/wk), and reduced risk of IHD in subjects preferring whole-grain to white bread. The lifetime risk of IHD was reduced by approximately 31% in those who consumed nuts frequently and by 37% in male vegetarians compared with nonvegetarians. Cancers of the colon and prostate were significantly more likely in nonvegetarians (RR of 1.88 and 1.54, respectively), and frequent beef consumers also had higher risk of bladder cancer. Intake of legumes was negatively associated with risk of colon cancer in nonvegetarians and risk of pancreatic cancer. Higher consumption of all fruit or dried fruit was associated with lower risks of lung, prostate, and pancreatic cancers. Cross-sectional data suggest vegetarian Seventh-day Adventists have lower risks of diabetes mellitus, hypertension, and arthritis than nonvegetarians. Thus, among Seventh-day Adventists, vegetarians are healthier than nonvegetarians.

Commentary: Beef doubles the risk of colon cancer; whereas eating nuts lower the risk.

P. S.

4 : Eur J Cancer Prev 1999 Jul;8(3):229-35

Foods as risk factors for colorectal cancer: a case-control study in Burgundy (France).

Boutron-Ruault MC, Senesse P, Faivre J, Chatelain N, Belghiti C, Meance S ISTNA, Conservatoire National des Arts et Metiers, Paris, France.

Although the high meat-low vegetable diet is considered the reference high-risk diet for colorectal cancer, particularly in USA communities, other at-risk dietary patterns, such as high intakes of processed meat and refined carbohydrates are emerging. Little is known about risk factors for colorectal cancer in France, a country at high risk of rectal cancer and moderately high risk of colon cancer. We compared diet of colorectal cancer cases (n = 171) and general population controls (n = 309) in Burgundy (France). Categories of intake were established by sex and based on the distributions of food intakes in controls. Odds ratios for the fourth vs first quartile of intake (OR4) were 2.0 (1.1-3.6) for refined cereal products (rice, pasta and pastry), 2.4 (1.3-4.5) for delicatessen, 2.3 (1.2-4.2) for pates, 1.7 (1.1-2.8) for offal and 2.1 (1.1-4.0) for butter, lard and cream. A protective effect of vegetables was only observed for left colon cancer (OR3 = 0.3; 0.1-0.6). In men, the most significant risk factors were refined cereal products, seasoning animal fats, chocolate and coffee, whereas risk factors were delicatessen, fat meat, pasta, rice, and chocolate in women. The strong association with refined cereal products is consistent with the hypothesis of a role of hyperinsulinism in colorectal carcinogenesis. The association with processed but not fresh meat suggests the importance of exogenous carcinogenesis in that area.

Commentary: Refined foods double colon cancer risk. P. S.

5 : Int J Cancer 1999 Jul 19;82(2):171-4

Risk factors for adenocarcinoma of the small intestine.

Negri E, Bosetti C, La Vecchia C, Fioretti F, Conti E, Francesch S Istituto di Ricerche Farmacologiche Mario Negri, Milan, Italy. evanegri@irfmm.mnegri.it

We have investigated the relation between alcohol, tobacco and dietary habits and risk of adenocarcinoma of the small intestine using data from 2 hospital-based case-control studies on intestinal cancers conducted in 6 Italian centres between 1985 and 1996. Cases were 23 patients below age 75 years with adenocarcinoma of the small intestine. Controls were 230 patients admitted to hospital for a wide spectrum of acute, non-neoplastic, non-digestive tract diseases, matched to cases on sex, age, study and centre. Odds ratios (ORs) were estimated using conditional logistic regression. Alcohol and tobacco consumption did not increase the risk of adenocarcinoma of the small intestine. The risk appeared to be directly related to intake of white bread, pasta or rice (OR = 3.8), sugar (OR = 2.9) and red meat (OR = 4.6), and inversely to coffee (OR = 0.4), fish (OR = 0.3), vegetables (OR = 0.3) and fruit (OR = 0.6). Our results suggest that dietary correlates of adenocarcinoma of the small intestine are similar to those of colon cancer and at least of the same magnitude. While the present data are inconsistent with a major effect of tobacco or alcohol, a moderate association between these factors and small bowel cancer may have been obscured by the play of chance.

Commentary: White bread, sugar and red meat triple colon cancer rates. Vegetables, fish and fruit cut it in half. P. S.

6 : Br J Cancer 1999 Mar;79(7-8):1283-7

Food groups and colorectal cancer risk.

Levi F, Pasche C, La Vecchia C, Lucchini F, Franceschi S Registre Vaudois des

Tumeurs, Institut universitaire de médecine sociale et préventive, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland.

Most studies of diet and colorectal cancer have considered nutrients and micronutrients, but the role of foods or food groups remains open to debate. To elucidate the issue, we examined data from a case-control study conducted between 1992 and 1997 in the Swiss canton of Vaud. Cases were 223 patients (142 men, 81 women) with incident, histologically confirmed colon (n= 119) or rectal (n= 104) cancer (median age 63 years), linked with the Cancer Registry of the Swiss Canton of Vaud, and controls were 491 subjects (211 men, 280 women, median age 58 years) admitted to the same university hospital for a wide spectrum of acute non-neoplastic conditions unrelated to long-term modifications of diet. Odds ratios (OR) were obtained after allowance for age, sex, education, smoking, alcohol, body mass index, physical activity and total energy intake. Significant associations were observed for refined grain (OR = 1.32 for an increase of one serving per day), and red meat (OR = 1.54), pork and processed meat (OR = 1.27), alcohol (OR = 1.28), and significant protections for whole grain (OR = 0.85), raw (OR = 0.85) and cooked vegetables (OR = 0.69), citrus (OR = 0.86) and other fruits (OR = 0.85), and for coffee (OR = 0.73). Garlic was also protective (OR = 0.32 for the highest tertile of intake). These findings in a central European population support the hypothesis that a diet rich in refined grains and red meat increases the risk of colorectal cancer; they, therefore, support the recommendation to substitute whole grains for refined grain, to limit meat intake, and to increase fruit and vegetable consumption.

Commentary: In Swiss people, red meat and alcohol increase risk; whole grains, vegetables and fruit cut the risk. Garlic reduces the risk 68%. P. S.

9 : Cancer Causes Control 1997 Nov;8(6):872-82

Diet diversity, diet composition, and risk of colon cancer (United States).

Slattery ML, Berry TD, Potter J, Caan B University of Utah, Salt Lake City 84108, USA.

In this study, we evaluate diet diversity, diet composition, and risk of colon cancer in an incident population-based study of 1,993 cases and 2,410 controls in the Kaiser Permanente Medical Care Program of Northern California, eight counties in Utah, and the Twin Cities area of Minnesota (United States). Ninety-one and one-half percent of the population were non-Hispanic White. Dietary intake was obtained using an adaptation of the CARDIA diet-history questionnaire. Diet diversity was defined as the number of unique food items reported; diversity also was explored within six major food groups. Composition of the diet was described by estimating the proportion of total number of food items contributed by major food groups. Younger individuals, higher educated individuals, and those who lived in larger households reported eating the most diverse diet. Total diet diversity was not associated with colon cancer. However, eating a diet with greater diversity of meats, poultry, fish, and eggs, was associated with a 50 percent increase in risk among all men (95 percent confidence interval [CI] = 1.1-2.0; P trend = 0.01), with slightly stronger associations for younger men and men with distal tumors. A diet with a greater number of refined grain products also was associated with increased risk among men (odds ratio [OR] = 1.7, CI = 1.3-2.3). Women who ate a diet with a more diverse pattern of vegetables were at approximately a 20 percent lower risk than women

who had the least diverse diet in vegetables. Assessment of diet composition showed that men who consumed a large proportion of their food items from meat, fish, poultry, and eggs were at an increased risk, with the most marked association being for distal tumors (OR = 1.7, CI = 1.2-2.5). Women who consumed the largest percentage of their food items in the form of plant foods (fruits, vegetables, or whole grains) were at a reduced risk of developing colon cancer (OR = 0.7, CI = 0.5-1.0).

Commentary: Refined grains increase risk 70%; whole grains, fruits and vegetables reduce risk 30%. P. S.

11 : Cancer 1997 Sep 1;80(5):858-64

Nutritional factors and colon carcinoma: a case-control study involving French Canadians in Montreal, Quebec, Canada.

Ghadirian P, Lacroix A, Maisonneuve P, Perret C, Potvin C, Gravel D, Bernard D, Boyle P Research Centre, Hotel-Dieu of Montreal, Department of Nutrition, Faculty of Medicine, University of Montreal, Quebec, Canada.

BACKGROUND: In a population-based case-control study of colon carcinoma and nutrition involving the francophone community in Greater Montreal, a total of 402 cases (200 males and 202 females) and 668 controls (239 males and 429 females) were interviewed. **METHODS:** Cases from 1989-1993 were identified through the admission offices of 5 major francophone teaching hospitals in Montreal and were ages 35-79 years. Controls matched by age, place of residence, and language were selected by a modified random digit dialing method. Information on dietary intake was collected with a quantitative food frequency questionnaire. **RESULTS:** No associations were evident between colon carcinoma and total energy, protein, or carbohydrate consumption, whereas a suggestive inverse association was found with total fat intake, with an odds ratio (OR) of 0.78 (P = 0.0637), and with saturated fat intake as well (OR = 0.71, P = 0.0893). A strongly significant inverse association was found with dietary fiber (OR = 0.50, P = 0.0018). The strongest inverse association concerning fiber was found with fiber from vegetable sources (OR = 0.57, P = 0.0096), and a suggestive (although nonsignificant) inverse association (OR = 0.74, P = 0.0687) was found with fiber from fruits. Calcium was inversely associated with risk (OR = 0.69, P = 0.0411), as was dietary intake of vitamin A (OR = 0.67, P = 0.0162), retinol, (OR = 0.069, P = 0.0409), vitamin E (OR = 0.53, P = 0.0028), and alphanatocopherol (OR = 0.63, P = 0.0256). Although there was no association demonstrated between dietary beta-carotene intake and risk, a suggestive (although nonsignificant) inverse association with intake of other types of carotene was observed (OR = 0.76, P = 0.0740). No association was found between intake of other nutrients investigated in this study and risk of colon carcinoma. **CONCLUSIONS:** There is strong evidence from epidemiologic studies that high intake of fat and meat are risk factors for colorectal carcinoma in humans, whereas high intake of vegetable and fruit are inversely associated with risk of colon carcinoma. The findings from this study are in agreement with this observation.

Commentary: Fat and meat increase risk; veggies and fruits reduce risk. P. S.

12 : Nutr Cancer 1997;28(3):289-301

An ecological study of trends in cancer incidence and dietary changes in Hong

Kong.

Koo LC, Mang OW, Ho JH Department of Community Medicine, University of Hong Kong, Hong Kong.

Cancer incidence rates from the Hong Kong Cancer Registry show significant increases in lung and colon cancers and decreases in nasopharyngeal cancer in both sexes from 1973 to 1992. Moreover, cervical cancer and male esophageal cancer have declined significantly, and changes in the trends of cancer of the following sites were of borderline significance: decreasing male laryngeal and female esophageal cancers and increasing prostate and female breast cancers. These changes have occurred along with dietary shifts in the population, from a diet predominantly of rice and small portions of meat, vegetables, and fish to one with larger portions of all foods but rice and eggs. The latter data were gathered from six government household surveys from 1963-64 to 1994-95. By combining the two data sets, correlation coefficients were calculated for per capita consumption patterns of eight foods (rice, pork, beef, poultry, saltwater fish, freshwater fish, fresh vegetables, and eggs) and cancer incidence data of the same year or 10 years later. Higher meat intakes were significantly and positively correlated with cancers of the colon, rectum, prostate, and female breast. The correlations also suggested that current diets were more influential than diets a decade before for cancers of the lung, esophagus, rectum, and prostate. Cancers of the nasopharynx and colon were significantly correlated with current and past diets. These results support the hypothesis that intakes of meat and its associated fat are risk factors for colon, rectal, prostate, and female breast cancers.

Commentary: Meat increases many forms of cancer. P. S.

13 : Int J Cancer 1997 Mar 28;71(1):14-9

Risk of adenocarcinoma of the stomach and esophagus with meat cooking method and doneness preference.

Weisenburger DD, Correa P, Zahm SH Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, MD 20892-7364, USA.

Meats cooked at high temperatures (frying, grilling) and for a long duration contain heterocyclic amines (HCAs), which are both mutagens and animal carcinogens. Additionally, barbecuing/grilling of meats produces polycyclic aromatic hydrocarbons (PAHs). Consumption of well-done meat has been associated with an increased risk of colon cancer but has not been evaluated as a risk factor for stomach or esophageal cancers. We conducted a population-based case-control study in 66 counties of eastern Nebraska. Telephone interviews were conducted with white men and women diagnosed with adenocarcinoma of the stomach (n = 176) and esophagus (n = 143) between July 1988 and June 1993 and 502 controls. The dietary assessment included several questions about usual cooking methods for meats and doneness preference for beef. High intake of red meat was associated with increased risks for both stomach and esophageal cancers. Overall, broiling or frying of beef, chicken or pork was not associated with the risk of these tumors. Barbecuing/grilling, reported as the usual cooking method for a small number of study participants, was associated with an elevated risk of stomach and esophageal cancers. After excluding those who reported usually barbecuing/grilling, a source of both PAHs and HCAs, we evaluated doneness level as a surrogate for HCA

exposure. Compared to a preference for rare/medium rare beef, odds ratios were 2.4 for medium, 2.4 for medium well and 3.2 for well done, a significant positive trend. Doneness level was not associated with a significant trend in risk of esophageal cancer. *Commentary: Medium and well-done meat has triple the cancer rate of rare meat. Don't forget, rare meat is a major cause of food poisoning. P. S.*

16 : Cancer Epidemiol Biomarkers Prev 1996 Jul;5(7):495-502

Relationship of food groups and water intake to colon cancer risk.

Shannon J, White E, Shattuck AL, Potter JD Division of Public Health Sciences, Fred Hutchinson Cancer Research Center, Seattle, Washington 98104, USA.

The association between food groupings and adenocarcinoma of the colon was investigated in a population-based case-control study of men and women ages 30-62 years. Colon cancer cases (238 men and 186 women) diagnosed from 1985 to 1989 were identified from the Seattle-Puget Sound Surveillance, Epidemiology, and End Results Registry. Controls (224 men and 190 women) were selected using a random digit telephone dialing method. Dietary information was gathered using an 80-item food frequency questionnaire. Foods were grouped and analyzed by quartile of intake, with adjustment for age and total energy intake. Among women, a reduced risk of colon cancer was associated with a high intake of fruits and vegetables [adjusted odds ratio (OR) for highest versus lowest quartile, 0.48; 95% confidence interval (CI), 0.26-0.86; P for trend, P = 0.02]. Inverse associations were also observed for the consumption of total (hot and cold) cereals (OR, 0.47; 95% CI, 0.25-0.91; P = 0.05), dairy products (OR, 0.40; 95% CI, 0.21-0.79; P = 0.05), and water (OR for > 5 glasses/day versus < or = 2 glass/day, 0.55; 95% CI, 0.31-0.99; P = 0.004). Among men, colon cancer risk was inversely associated with the intake of breads and cereals (OR, 0.43; 95% CI, 0.22-0.82; P = 0.02) and hot cereal (OR for weekly versus never eating, 0.53; 95% CI, 0.32-0.87; P = 0.01). Water consumption was marginally associated with a decreased colon cancer risk among men as well (OR for > 4 glasses/day versus < or = 1 glass/day, 0.68; 95% CI, 0.38-1.22; P = 0.16). Total meat consumption was associated with an increased risk of distal colon cancer among men (OR, 2.20; 95% CI, 1.08-4.48; P = 0.01). These results were not confounded by body mass index or other measured health behaviors. Results of this research support previous findings which associate intake of fruits, vegetables, grains, and dairy products with reduced colon cancer risk, and meat intake with an increased colon cancer risk. This study also reports a new finding of a possible inverse association of water consumption (glasses of plain water per day) with colon cancer risk. *Commentary: Fruit and vegetables cut colon risk in half. Ditto for cereals or water. Meat doubled cancer risk. P. S.*

18: Adv Exp Med Biol 1996;399:87-94

Metabolism of exogenous and endogenous arachidonic acid in cancer.

Phinney SD Department of Internal Medicine, University of California at Davis 95616, USA.

Epidemiologic evidence in humans and controlled trials in animal models indicate that total dietary fat increases the risk of cancer. The animal evidence indicates that the

greatest efficacy in promoting carcinogenesis is achieved with omega-6 fatty acids with little or no effect from either the omega-3 or monounsaturated fatty acid families. Epidemiologic studies in humans indicate a positive association between meat intake and colon cancer, but a negative association with chicken and fish. There is also a negative association between non-steroidal anti-inflammatory drug (NSAID) intake and colon cancer. Red meat is a potentially significant source of dietary arachidonic acid, which is the primary substrate for the eicosanoids whose production is blocked by NSAIDs. Thus there is a positive association between carcinogenesis and dietary intake of both the omega-6 fatty acid precursor linoleic acid and its product arachidonic acid, and a negative association with use of a drug blocking its metabolism to eicosanoids. Another potentially important factor in arachidonate metabolism is variation in its endogenous distribution. We have recently reported abnormal distribution of arachidonic acid between lipid fractions in human obesity, and parallel abnormalities in animal models of genetic obesity. This implies a potential role for variation in the endogenous distribution of arachidonic acid in the etiology of cancers which have increased incidence in human obesity. This paper addresses the role of arachidonate intake, its endogenous production, and its distribution within lipid fractions in carcinogenesis.

Commentary: Red meat and Omega-6 fats (e.g. corn oil) increases arachidonic acid levels which promote cancer. P. S.

19: Cancer Causes Control 1995 Mar;6(2):164-79 Related Articles, Books

Insulin and colon cancer.

Giovannucci E Channing Laboratory, Department of Medicine, Harvard Medical School, Boston, MA 02115, USA.

Some factors related to Westernization or industrialization increase risk of colon cancer. It is believed widely that this increase in risk is related to the direct effects of dietary fat and fiber in the colonic lumen. However, the fat and fiber hypotheses, at least as originally formulated, do not explain adequately many emerging findings from recent epidemiologic studies. An alternative hypothesis, that hyperinsulinemia promotes colon carcinogenesis, is presented here. Insulin is an important growth factor of colonic epithelial cells and is a mitogen of tumor cell growth in vitro. Epidemiologic evidence supporting the insulin/colon-cancer hypothesis is largely indirect and based on the similarity of factors which produce elevated insulin levels with those related to colon cancer risk. Specifically, obesity--particularly central obesity, physical inactivity, and possibly a low dietary polyunsaturated fat to saturated fat ratio--are major determinants of insulin resistance and hyperinsulinemia, and appear related to colon cancer risk. Moreover, a diet high in refined carbohydrates and low in water-soluble fiber, which is associated with an increased risk of colon cancer, causes rapid intestinal absorption of glucose into the blood leading to postprandial hyperinsulinemia. The combination of insulin resistance and high glycemic load produces particularly high insulin levels. Thus, hyperinsulinemia may explain why obesity, physical inactivity, and a diet low in fruits and vegetables and high in red meat and extensively processed foods, all common in the West, increase colon cancer risk.

Commentary: Sugar causes high insulin levels, which increase cancer. P. S.

20: Asia Pac J Public Health 1995;8(2):118-22

Colorectal cancer risk factors: a case-control study in Bangkok.

Lohsoonthorn P, Danvivat D Department of Preventive and Social Medicine, Chulalongkorn University, Bangkok, Thailand.

A case-control study for colorectal cancer risk factors was conducted in Bangkok, Thailand. A total of 279 incident cases of colorectal cancer were individually matched by sex, age and same hospital to 279 hospital controls with other cancers except gastrointestinal cancer. Each subject was interviewed with regard to bowel pattern information, family history, past history of illness and dietary information. The major findings were elevated risk for those with a history of bowel polyps (OR = 14.69, 95% CI = 2.01-301.46), parent's history of colon cancer (OR = 4.00, 95% CI = 1.39-12.43), anal abscess (OR = 3.78, 95% CI = 0.97-17.24), chronic colitis (OR = 3.61, 95% CI = 1.67-8.00), chronic hemorrhoid (OR = 3.13, 95% CI = 2.03-4.86) **and the frequency of stools every three days or more (OR = 2.16, 95% CI = 1.17-4.01)**. The results also indicated an increased risk for dietary factors; **bacon (OR = 12.49, 95% CI = 1.68-269.1) and butter (OR = 2.68, 95% CI = 1.29-5.68)**. There was **a protective effect provided by banana (OR = 0.54, 95% CI = 0.37-0.79) and papaya (OR = 0.58, 95% CI = 0.40-0.84)** for colorectal cancer. In unconditional logistic regression analysis, bacon showed the highest risk for colorectal cancer (OR = 8.82, 95% CI = 1.03-75.57), instead of bowel polyps (OR = 4.50, 95% CI = 0.48-42.59). The data suggest that nitrite-treated meat increases colorectal cancer risk while dietary fiber decreases colorectal cancer risk.

Commentary: Being constipated doubles the risk of colon cancer. Butter increases risk 22 times, and bacon 122 times. Bananas or papayas are helpful. P. S.

21: Princess Takamatsu Symp 1995;23:292-8

Epidemiologic studies on fried foods and cancer in Sweden.

Gerhardsson de Verdier M Centre for Epidemiology, National Board of Health and Welfare, Stockholm, Sweden.

Three population-based case-control studies in Sweden have found an association between fried foods and pancreatic cancer, urothelial cancer and colorectal cancer, respectively. Only one of these studies included questions about the preferred method of frying the meat surface. This study was performed in Stockholm in 1986-88 and included 347 cases of colon cancer, 212 cases of rectal cancer and 505 controls. Total meat intake, frequent consumption of brown gravy, and a preference for a heavily browned meat surface each independently increased the risk for colorectal cancer. The relative risks (RRs) were higher for frequent intake of boiled meat (RR colon = 1.7, RR rectum = 2.7) than for frequent intake of meat fried with a medium or lightly browned surface (RR colon = 0.8, RR rectum = 1.1), **but the highest risks were for frequent intake of meat fried with a heavily browned surface (RR colon = 2.8, RR rectum = 6.0)**. The analyses were adjusted for year of birth, gender and fat intake. Further adjustments for total energy, dietary fiber intake, body mass and physical activity had little or no influence on the relative risks. These results indicate that the cooking method is a neglected risk factor for cancer, but also that the measurements of exposure, used so far, are inadequate. First, the agents (exposure) of interest have to be identified in laboratory

studies; secondly, accurate methods to measure the exposure in epidemiologic studies have to be established; and thirdly, these methods have to be used in well-designed epidemiologic studies.

Commentary: Well-cooked meat triples colon cancer risk, but increases rectum cancer sixfold. P. S.

22: Cancer Res 1994 May 1;54(9):2390-7

Intake of fat, meat, and fiber in relation to risk of colon cancer in men.

Giovannucci E, Rimm EB, Stampfer MJ, Colditz GA, Ascherio A, Willett WC Channing Laboratory, Department of Medicine, Harvard Medical School, Boston, Massachusetts.

Some evidence suggests that diets high in animal fat or red meat may increase the risk of colon cancer, whereas high intake of fiber or vegetables may be protective. Frequently, intake of red meat has been a stronger risk factor than total fat. Because data from prospective cohort studies are sparse, we examined fat, meat, fiber, and vegetable intake in relation to risk of colon cancer in a cohort of 47,949 U.S. male health professionals who were free of diagnosed cancer in 1986. At baseline, these men, 40 to 75 years of age, completed a validated food frequency questionnaire and provided detailed information on other lifestyle and health-related factors. Between 1986 and 1992, 205 new cases of colon cancer were diagnosed in these men. Intakes of total fat, saturated fat, and animal fat were not related to risk of colon cancer. However, an elevated risk of colon cancer was associated with red meat intake (relative risk, 1.71; 95% confidence interval, 1.15-2.55 between high and low quintiles; $P = 0.005$ for trend). Men who ate beef, pork, or lamb as a main dish five or more times per week had a relative risk of 3.57 (95% confidence interval, 1.58-8.06; $P = 0.01$ for trend) compared to men eating these foods less than once per month. The association with red meat was not confounded appreciably by other dietary factors, physical activity, body mass, alcohol intake, cigarette smoking, or aspirin use. Other sources of animal fat, including dairy products, poultry, and fish as well as vegetable fat, were slightly inversely related to risk of colon cancer. No clear association existed between fiber or vegetable intake and risk of colon cancer. These data support the hypothesis that intake of red meat is related to an elevated risk of colon cancer.

Commentary: Red meat, just five times per week, increases colon cancer 357%. P. S.

23: Am J Clin Nutr 1999 Dec;70(6):1107-10

Refined-cereal intake and risk of selected cancers in Italy.

Chatenoud L, La Vecchia C, Franceschi S, Tavani A, Jacobs DR Jr, Parpinel MT, Soler M, Negri E Istituto di Ricerche Farmacologiche Mario Negri, Milan, Italy
bonifacino@irfmm.negri.it

BACKGROUND: Although consumption of whole-grain foods seems to reduce the risk of several types of neoplasms, the potential influence of a diet rich in starches and refined grains is less clear. **OBJECTIVE:** We studied the relation between the frequency of consumption of refined cereals (bread, pasta, or rice) and the risk of selected neoplasms. **DESIGN:** This was an integrated series of case-control studies conducted in northern Italy between 1983 and 1993. The subjects were patients admitted to the major teaching and general hospitals in Milan and Pordenone with incident, histologically confirmed

cancers: 343 with cancer of the oral cavity and pharynx, 94 with cancer of the esophagus, 146 with cancer of the larynx, 745 with cancer of the stomach, 955 with cancer of the colon, 625 with cancer of the rectum, and 428 with cancer of the thyroid. The control subjects were 3526 patients admitted to the same network of hospitals for acute nonneoplastic conditions unrelated to long-term modification of diet. Odds ratios (ORs) for consecutive tertiles of refined-cereal consumption were computed after allowance for sociodemographic variables, education, smoking status, alcohol consumption, body mass index, and consumption of fruit, vegetables, and whole-grain foods. **RESULTS:** The ORs for the highest tertile of refined-cereal intake were 1.6 for cancer of the oral cavity, pharynx, esophagus, or larynx; 1.5 for stomach cancer; 1.5 for colon cancer; 1.3 for cancer of the rectum; and 2.0 for thyroid cancer. The trends in risk were significant for all neoplasms considered. **CONCLUSION:** Consumption of refined cereals was associated with an increased risk of cancers of the large bowel, the stomach, and other selected digestive and nondigestive sites.

Commentary: Refined cereals increased stomach and colon cancer by 50%. P. S.

24: Am J Clin Nutr 1999 Jul;70(1):85-90

Fish consumption and cancer risk.

Fernandez E, Chatenoud L, La Vecchia C, Negri E, Franceschi S

Institut Universitari de Salut Publica de Catalunya, L'Hospitalet (Barcelona), Catalonia, Spain. efernandez@bell.ub.es

BACKGROUND: Although several studies have investigated the relation between fish consumption and the risk of cardiovascular diseases, less attention has been paid to the relation between fish consumption and cancer risk. **OBJECTIVE:** The relation between frequency of consumption of fish and risk of selected neoplasms was analyzed by using data from an integrated series of case-control studies conducted in northern Italy between 1983 and 1996. **DESIGN:** The overall data set included the following incident, histologically confirmed neoplasms: oral cavity and pharynx (n = 181), esophagus (n = 316), stomach (n = 745), colon (n = 828), rectum (n = 498), liver (n = 428), gallbladder (n = 60), pancreas (n = 362), larynx (n = 242), breast (n = 3412), endometrium (n = 750), ovary (n = 971), prostate (n = 127), bladder (n = 431), kidney (n = 190), thyroid (n = 208), Hodgkin disease (n = 80), non-Hodgkin lymphomas (n = 200), and multiple myelomas (n = 120). Control subjects were 7990 patients admitted for acute, nonneoplastic conditions unrelated to long-term modifications of diet. Odds ratios (ORs) were computed for subsequent levels of fish consumption compared with no or occasional consumption (<1 serving/wk) by using multiple logistic regression, including terms for several covariates. **RESULTS:** There was a consistent pattern of protection against the risk of digestive tract cancers with fish consumption: oral cavity and pharynx, OR = 0.5 for the highest compared with the lowest level of consumption; esophagus, OR = 0.6; stomach, OR = 0.7; colon, OR = 0.6; rectum, OR = 0.5; and pancreas, OR = 0.7. There were inverse trends in risk of larynx (OR = 0.7), endometrial (OR = 0.8), and ovarian (OR = 0.7) cancers and multiple myeloma (OR = 0.5). No pattern of cancer risk in relation to fish consumption was observed for cancers of the liver, gallbladder, breast, bladder, kidney, or thyroid or for lymphomas. **CONCLUSION:** This study suggests that

the consumption of even relatively small amounts of fish is a favorable indicator of the risk of several cancers, especially of the digestive tract.

Commentary: Regular fish consumption reduced incidences of several types of cancer by 30 to 50% because of its Omega-3 and antioxidant content. P. S.