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Dietary habits and relation to cancer disease in different population

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Abstract

Cancer is a disease characterized by the uncontrolled growth and spread of abnormal cells. Around the world, over 10 million cancer cases occur annually. Over one million people in the United States get cancer each year. Anyone can get cancer at any age; however, about 80 percent of all cancers occur in people over the age of fifty-five. Cancer can affect any site in the body. About one hundred human cancers are recognized. There is a marked variation among countries in incidence of different cancers. Most of the variation in cancer risk among populations, and among individuals, is due to environmental factors, such as cigarette smoking and certain dietary patterns, which can affect one's risk of developing cancer. All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. Approximately 30 percent of all cancers worldwide are due to tobacco use. Many of the skin cancers could be prevented by protection from sunlight. Certain cancers that are related to infectious exposures could be prevented through behavioural changes, vaccines, or antibiotics. The relation between dietary components (Functional Foods) and a disease are regulated by the United States Food and Drug Administration (FDA) under the authority of two laws; The Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 provides for the regulation of all foods and food additives. Eating habits in high and low socioeconomic (SES) groups is considered as one of the most powerful predictors of health status and mortality worldwide. High-risk health behaviours are more common in persons of low SES (LSES). The excess mortality and morbidity associated with LSES have commonly been attributed to high-risk health behaviours including diet, smoking, lack of physical activity, and obesity .Further, the increase incidence of cancer risk in different population was associated mainly with consumption of preserved fish, cold cuts , oleaginous fruits, alcohol, pasta , rice, and eggs. Diets rich in vegetables, fruits and with low amounts of salty and starchy foods are recommendable for the prevention of gastric cancer. Right fat, fiber intake , Raw fruits and vegetables, Switch from red meat to seafood, Switch from an animal-based diet to a plant-based diet, intake Foods containing calcium, Diet high in antioxidants, Vitamin D, Selenium, garlic and green tea supports the immune system and fit into cancer disease-risk reduction.

Introduction

Cancer is a disease characterized by the uncontrolled growth and spread of abnormal cells. Around the world, over 10 million cancer cases occur annually. Half of all men and one-third of all women in the United States will develop some form of cancer during their lifetime. It is one of the most feared diseases, primarily because half of those diagnosed with cancer in the United States will die from it. Cancer is a leading cause of death around the world, causing over 6 million deaths a year. The exact causes of most types of cancer are still not known, and there is not yet a cure for cancer. However, it is now known that the risk of developing many types of cancer can be reduced by adopting certain lifestyle changes, such as quitting smoking and eating a better diet [1].

Photo by: Arto

Liver cancer
New Cancer Therapy A new and promising treatment for all cancers.
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Prevalence

Cancer is, in general, more common in industrialized nations, but there has been a growth in cancer rates in developing countries, particularly as these nations adopt the diet and lifestyle habits of industrialized countries. Over one million people in the United States get cancer each year. Anyone can get cancer at any age; however, about 80 percent of all cancers occur in people over the age of fifty-five. Cancer can affect any site in the body. About one hundred human cancers are recognized. The four most common cancers in the United States are: lung, colon/rectum, breast, and prostate . Together, these cancers account for over 50 percent of total cancer cases in the United States each year. There is a marked variation among countries in incidence of different cancers. Most of the variation in cancer risk among populations, and among individuals, is due to environmental factors, such as cigarette smoking and certain dietary patterns, which can affect one's risk of developing cancer. For example, individuals living in Australia have the highest worldwide lifetime risk of skin cancer, at over 20 percent, due to the high level of exposure to the sun of people in Australia. People in India have twenty-five times the average risk of developing oral cancer sometime during their lives due to the popularity of chewing tobacco in that country. In fact, India has the world's highest incidence of oral cancer, with 75,000 to 80,000 new cases a year. The population of Japan has the highest rates of stomach cancer in the world due to the high consumption of raw fish by the Japanese [1].

Types of Cancer

Cancers are classified according to the types of cells in which they develop. Most human cancers are carcinomas, which arise from the epithelial cells that form the superficial layer of the skin and some internal organs. Leukemias affect the blood and blood-forming organs such as bone marrow, the lymphatic system, and the spleen. Lymphomas affect the immune system. Sarcoma is a general term for any cancer arising from muscle cells or connective tissues [2].

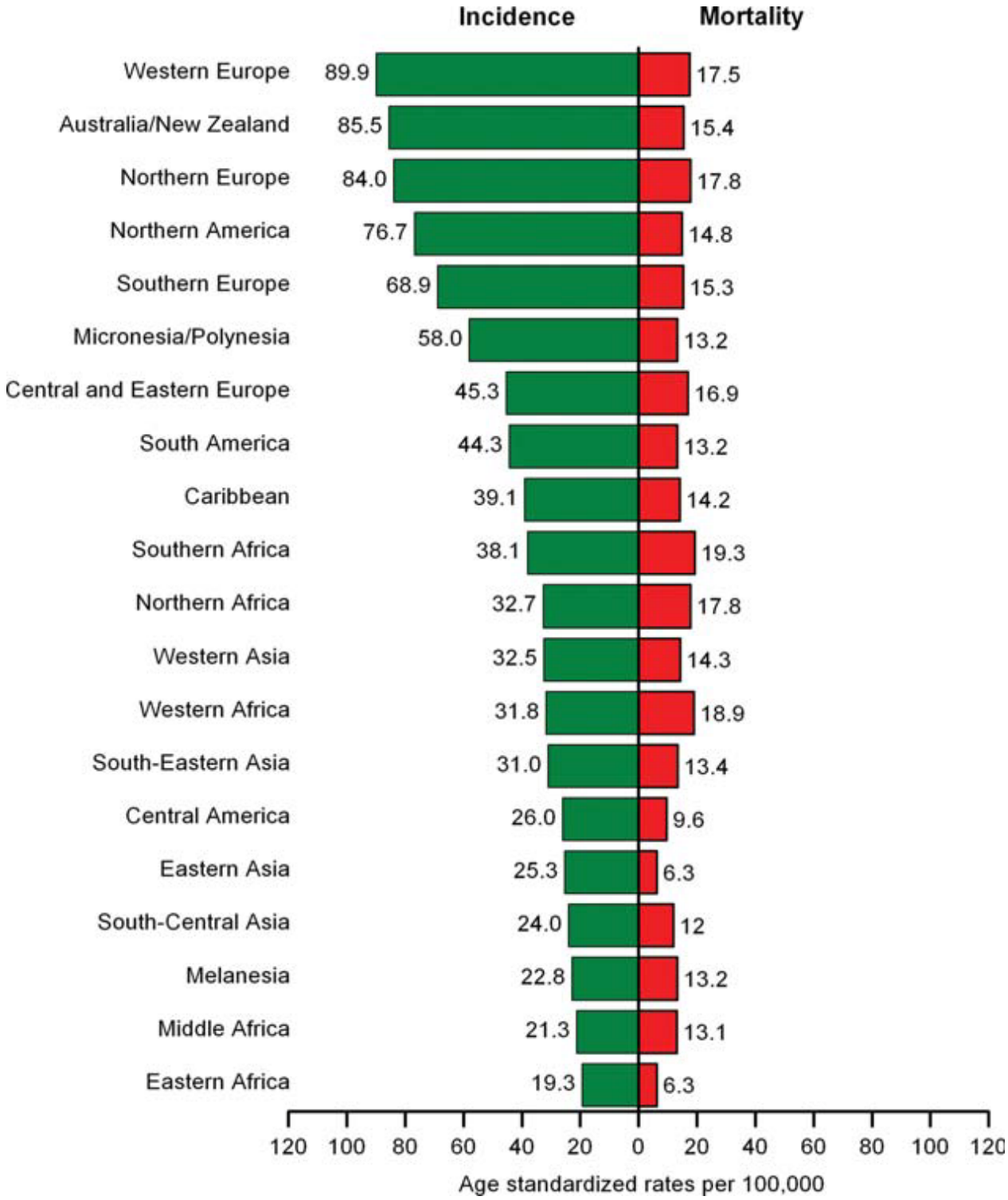
Growth and Spread of Cancer

Cancer develops when cells in a particular part of the body begin to grow out of control. Normal body cells grow, divide, and die in an orderly way. Cancer cells, however, continue to grow and divide without dying. Instead, they outlive normal cells and continue to form new abnormal cancer cells. As most cancer cells continue to grow, they lump together and form an extra mass of tissue. This mass is called a malignant tumor. As a malignant tumor grows, it damages nearby tissue. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues, where they grow. Cancer can begin in one part of the body and spread to others. The spread of a tumor to a new site is called metastasis. This process occurs as cancer cells break away from a tumor and travel through the bloodstream or the lymph system to other areas of the body. Once in a new location, cancer cells continue to grow out of control and form a new malignant tumor [2].

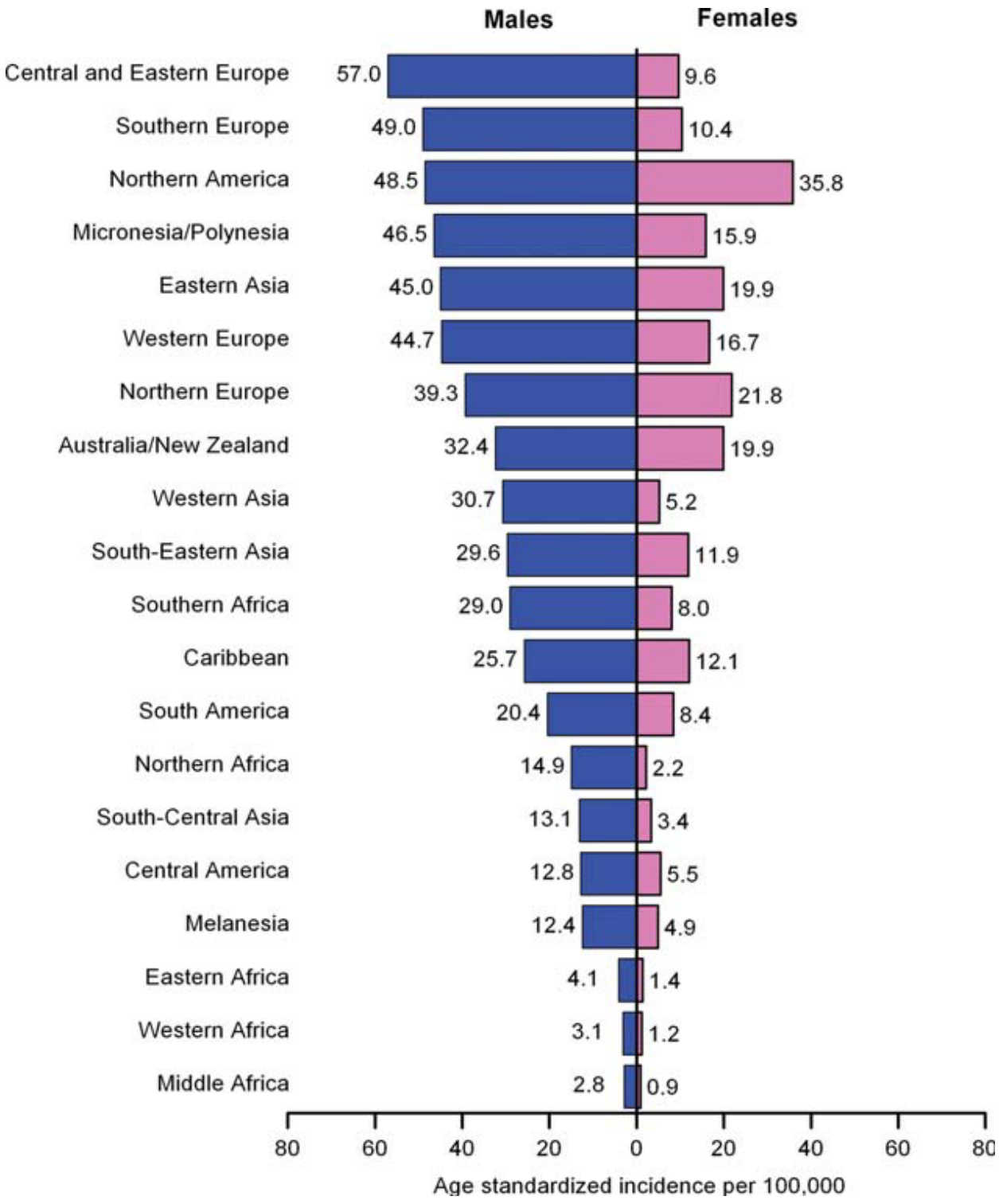
Causes of Cancer

The exact cause of cancer is not known. Most cancers result from permanent damage to genes or from mutations, which occur either due to internal factors, such as hormones, immune conditions, metabolism, and the digestion of nutrients within cells, or by exposure to environmental or external factors. A chemical or other environmental agent that produces cancer is called a carcinogen.

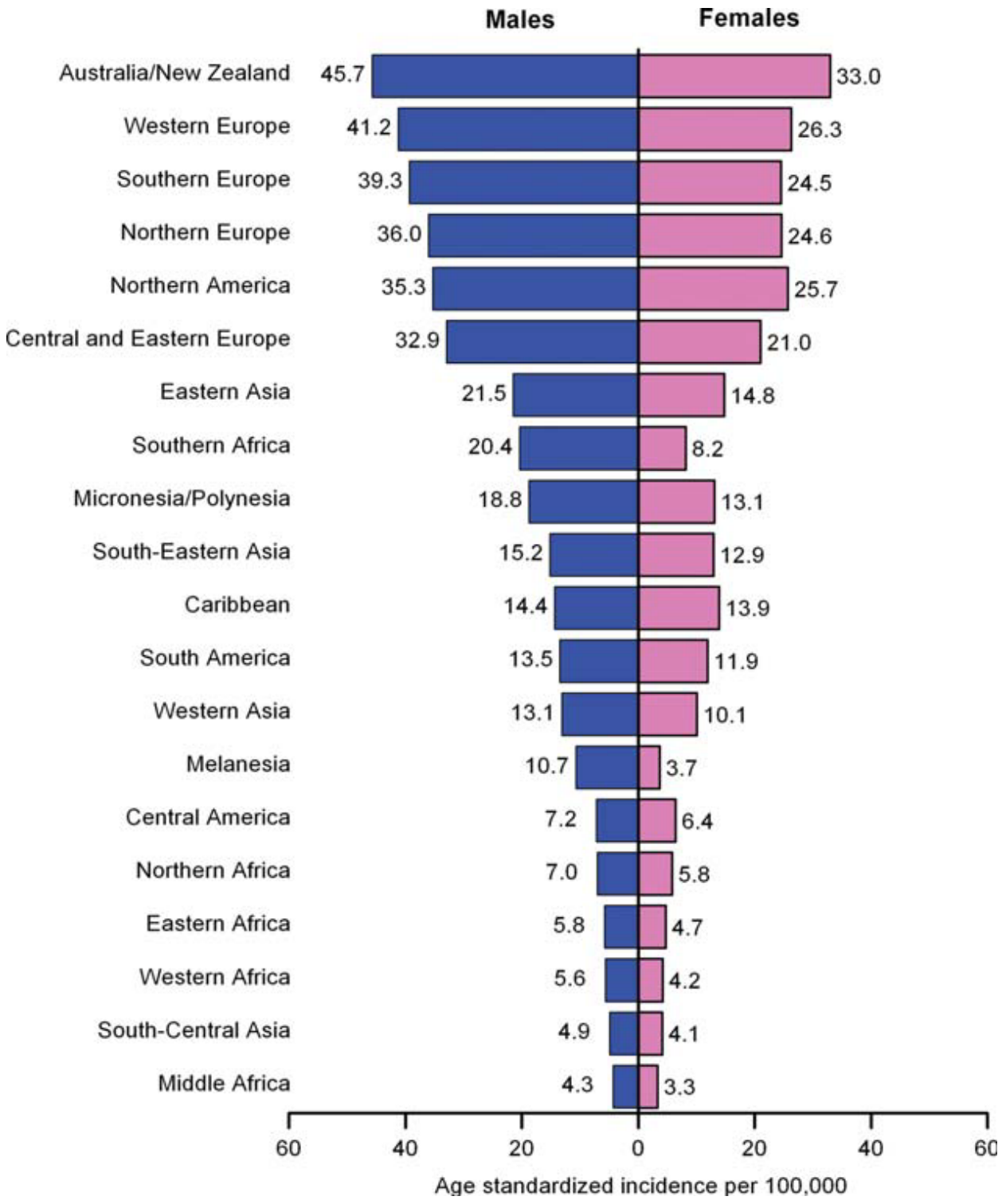
Overall, environmental factors, defined broadly to include tobacco use, diet, infectious diseases, chemicals, and radiation,



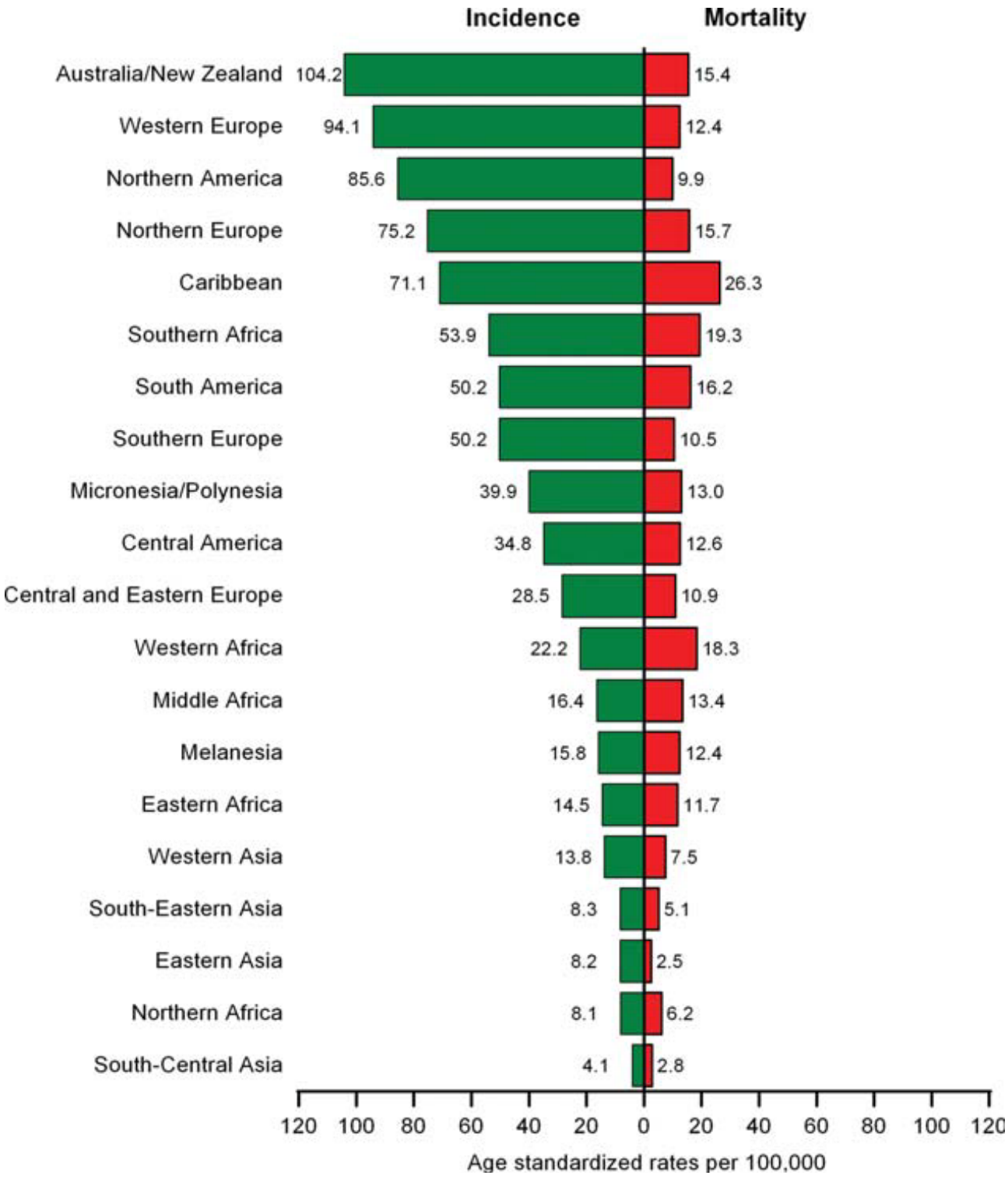
Age-Standardized Breast Cancer Incidence and Mortality Rates by World Area. Source: GLOBOCAN 2008.



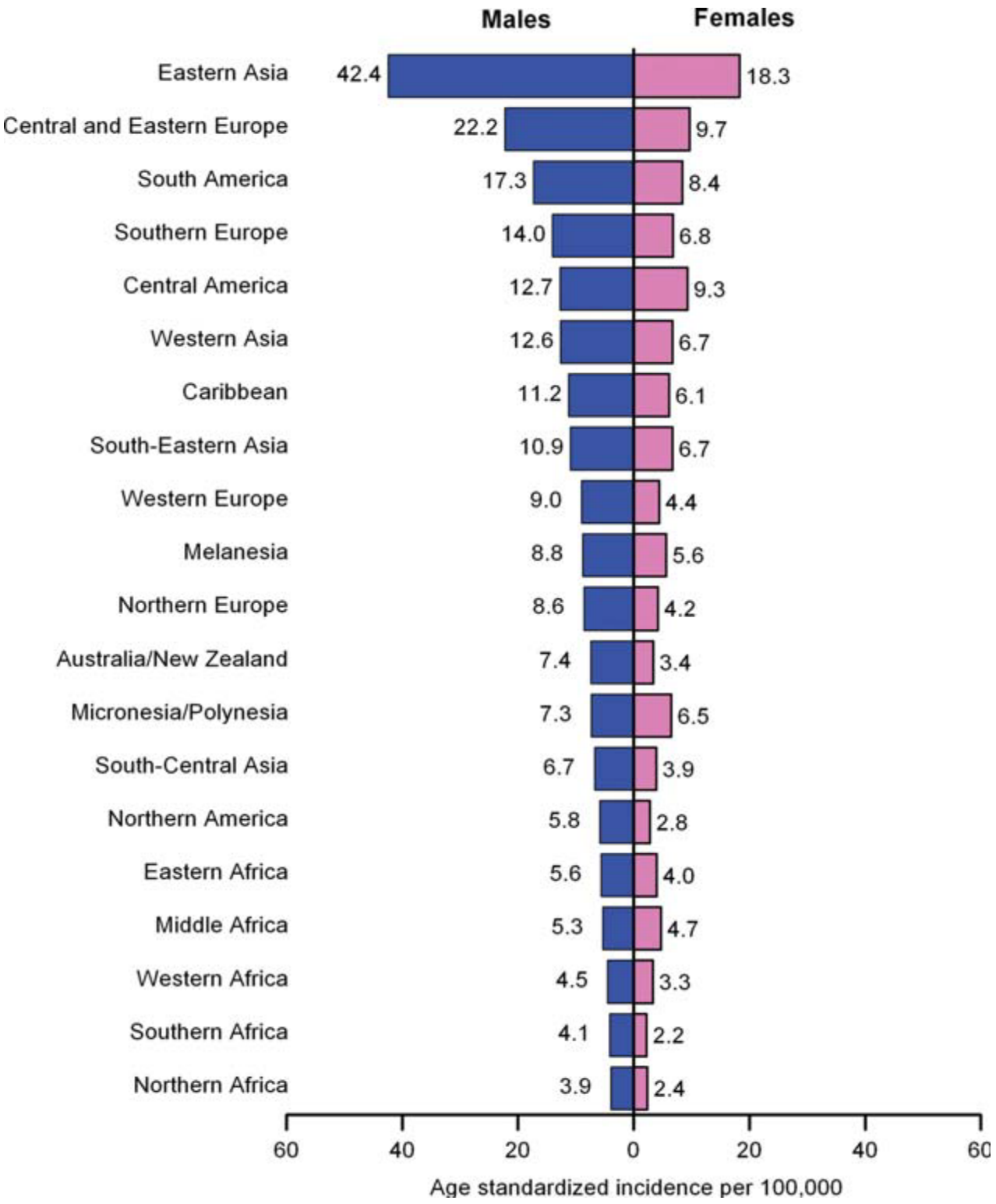
Age-Standardized Lung Cancer Incidence Rates by Sex and World Area. Source: GLOBOCAN 2008.



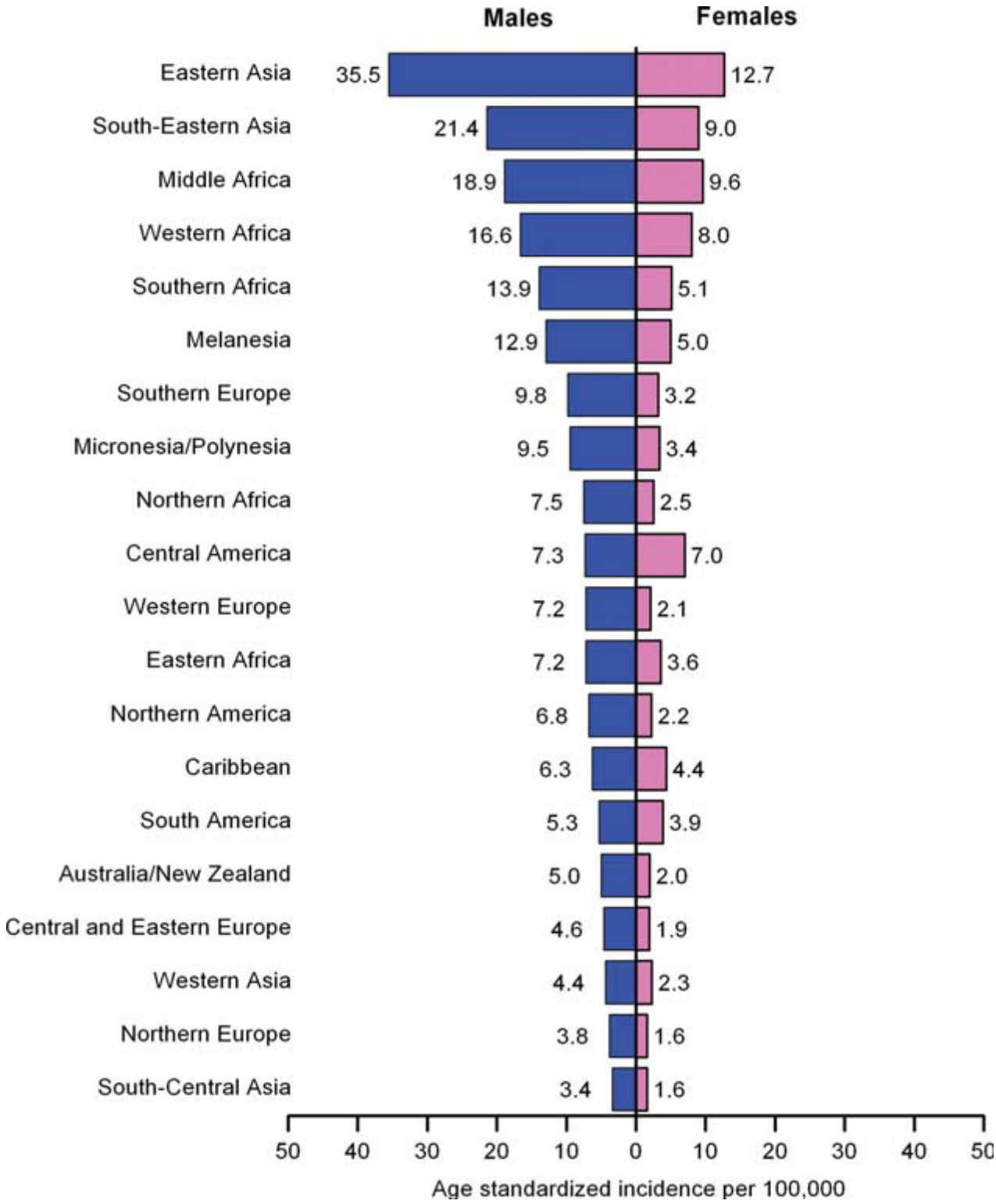
Age-Standardized Colorectal Cancer Incidence Rates by Sex And World Area. Source: GLOBOCAN 2008



Age-Standardized Prostate Cancer Incidence and Mortality Rates by World Area. Source: GLOBOCAN 2008



Age-Standardized Stomach Cancer Incidence Rates by Sex and World Area. Source: GLOBOCAN 2008



Age-Standardized Liver Cancer Incidence Rates by Sex and World Area. Source: GLOBOCAN 2008.

are believed to cause between 75 and 80 percent of all cancer cases in the United States. Tobacco use, including cigarettes, cigars, chewing tobacco, and snuff, can cause cancers of the lung, mouth, throat, larynx, bladder, kidney, esophagus, and pancreas. Smoking alone causes one-third of all cancer deaths in the United States. Heavy consumption of alcohol has also been shown to increase the risk of developing cancer of the mouth, pharynx, larynx, esophagus, liver, and breast. Overweight and obesity are associated with increased risk of cancers of the breast, colon, endometrium, esophagus, kidney, and gallbladder. The following chemicals have been found to cause cancer: coal tars and their derivatives, such as benzene; some hydrocarbons; aniline, a substance used to make dyes; and asbestos. Radiation from a variety of sources, including the ultraviolet light from the sun, is known to lead to skin cancer.

Several infectious agents have also been implicated in cancer. Evidence suggests that chronic viral infections are associated with up to one-fifth of all cancers. These include hepatitis B virus (HBV), which can lead to cancer of the liver; the Epstein-Barr virus, a type of herpes virus that causes infectious mononucleosis and has been associated with Hodgkin's disease, non-Hodgkin's lymphomas, and nasopharyngeal cancer; the human immunodeficiency virus (HIV), which is associated with an increased risk of developing several cancers, especially Kaposi's sarcoma and non-Hodgkin's.

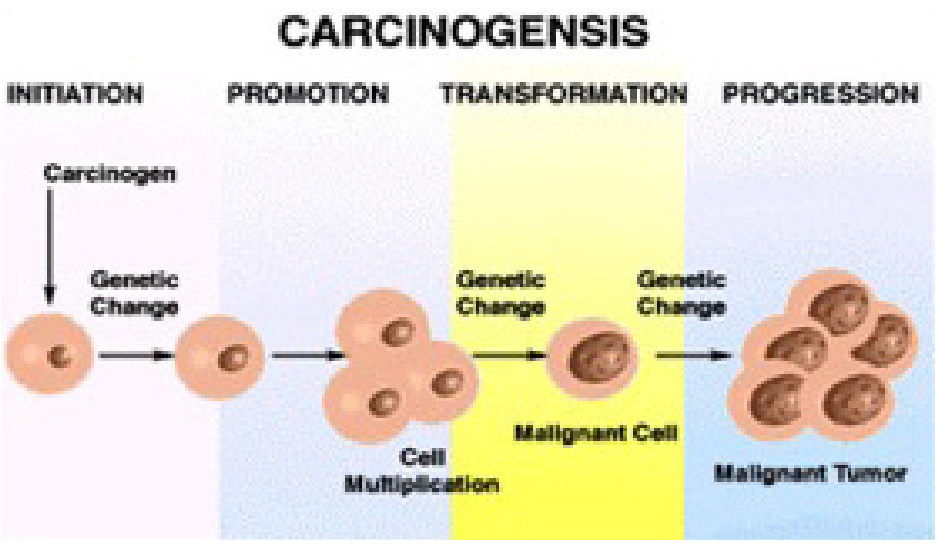
Tobacco use is a major cause of lung, lip, mouth, larynx, and throat cancer, and is a contributing cause of many other cancers. In India, where this photo was taken, the prevalence of tobacco use among students approaches 60 percent in some states. Lymphoma; and human papilloma viruses (HPV), which have been proven to cause cervical cancer and have also been associated with cancers of the vagina, vulva, penis, and colon. The bacterium Helicobacter pylori have been linked to stomach cancer.

About 5 to 10 percent of cancers are hereditary, in that a faulty gene or damaged DNA that has been inherited predisposes a person to be at a very high risk of developing a particular cancer. Two genes, BRCA1 and BRCA2, have been found to cause some breast cancers. Other genes have been discovered that are associated with some cancers that run in families, such as cancers of the colon, rectum, kidney, ovary, esophagus, lymph nodes, skin melanoma, and pancreas [3].

Carcinogenesis Process

All cancers involve the malfunction of genes that control cell growth and division. The process by which cancers develop is called carcinogenesis. This process usually starts when chemicals or radiation damage DNA, the genetic structure inside cells. Viruses induce carcinogenesis by introducing new DNA sequences. Most of the time, when DNA becomes damaged the body is able to repair it. In cancer cells, however, the damaged DNA is not repaired. While normal cells with damaged DNA die, cancer cells with damaged DNA continue to multiply.

There is a long time lag between exposure to a carcinogen and the occurrence of cancer. While cellular mutations cause cancer to develop, it is not exactly clear how this happens. Carcinogenesis is a multistep process, in which as many as ten distinct mutations may have to accumulate in a cell before it becomes cancerous. The fact that so many mutations are needed for a cancer to develop indicates that cell growth is normally controlled through many sets of checks and balances.



www.medscape.com source: cancer control @2007, Lee H cancer center and research Institute ,Inc.

When cells in some area of the body divide without control, these cells accumulate and form lumps. A tumor, or neoplasm, is an abnormal lump or mass of tissue that may compress, invade, and destroy normal tissue. Tumors may be benign or malignant. Cancer is a malignant neoplasm, though not all tumors are malignant. A noncancerous growth is called a benign tumor. Benign tumors do not metastasize and, with very rare exceptions, are not life threatening.

The cell cycle is regulated by a large number of cellular genes that are expressed, or exhibited, at different stages of the cycle. The genes code for, or determine, growth factors, growth-factor receptors, and proteins that control gene functions and cell survival. Damaged DNA can lead to cancer because the cell cycle is distorted by the alteration and activation of oncogenes, genes that stimulate cell growth, or by the inactivation of tumor suppressor genes, which ordinarily suppress cell growth. Activated oncogenes drive abnormal, unregulated cell proliferation and lead to tumor formation. Mutations of the tumor suppressor gene p53 are found in about 50 percent of human cancers.

In experimental animals, three stages of chemical carcinogenesis have been identified. These are: (1) initiation, where DNA is irreversibly altered; (2) promotion, which is the multiplication of altered cells; and (3) progression, which involves chromosomal changes, high growth rate, invasiveness, and potential to metastasize[3].

Prevention

All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. Approximately 30 percent of all cancers worldwide are due to tobacco use. Many of the skin cancers could be prevented by protection from sunlight. Certain cancers that are related to infectious exposures, such as HBV, HPV, HIV, and Helicobacter could be prevented through behavioral changes, vaccines, or antibiotics. Research shows that about 30 to 40 percent of all cancers worldwide are due to dietary factors and lack of physical activity, including obesity, and could therefore have been prevented. By making changes in regard to diet, exercise, healthy weight maintenance, and tobacco use, the incidence of cancer around the world could be reduced by 60 to 70 percent [3].

Internet Resources

American Cancer Society. "Cancer Facts and Figures, 2002." Available from <http://www.cancer.org/downloads>
National Cancer Institute (2000). "Cancer Facts: Questions and Answers About Cancer." Available from <http://www.nci.nih.gov>

Functional Foods

Functional foods are regulated by the United States Food and Drug Administration (FDA) under the authority of two laws. The Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 provides for the regulation of all foods and food additives. The Dietary Supplement Health and Education Act (DSHEA) of 1994 amended the FD&C Act to cover dietary supplements and ingredients of dietary supplements. Functional foods may be categorized as whole foods, enriched foods, fortified foods, or enhanced foods. Labeling claims that are used on functional foods are of two types: (1) Structure and function claims, which describe effects on normal functioning of the body, but not claims that the food can treat, diagnose, prevent, or cure a disease (claims such as "promotes regularity," "helps maintain cardiovascular health," and "supports the immune system " fit into this category; and (2) Disease-risk reduction claims, which imply a relationship between dietary components and a disease or health condition [4].

Structure and function claims do not require preapproval by the FDA, and they require much less stringent scientific consensus than disease-risk reduction claims. Under the FD&C Act, structure and function claims cannot be false or misleading. However, the law does not define the nature or extent of evidence necessary to support these claims. To complicate matters, the evidence available to support structure and function claims varies widely [5, 6].

Antioxidants

Americans spend several billion dollars a year on antioxidants in an effort to improve their health. Science has been looking at antioxidants and their role in everything from preventing cancer and heart disease to boosting the immune system and slowing the aging process. Antioxidants provide a layer of protection for the cells and tissues of the body, just as a thick coat of wax helps protect a car's finish. Specifically, antioxidants protect against free radical damage.

Actually promote free radical production, also known as prooxidation, increasing the chance for health problems. Those who may benefit most from antioxidants include people dealing with a lot of stress , dieters limiting their calories to 1,200 per day or less, people on a low-fat diet, smokers, older adults, and people with a family history of heart disease or cancer[7].

Phytochemicals

Phytochemicals are naturally occurring chemicals in plants that provide flavor, color, texture, and smell. Phytochemicals

Types of functional foods

Functional food	Potential health benefit	Labeling claim
Whole foods		
Oats	Reduces cholesterol and constipation, reduces risk of heart disease	May reduce the risk of heart disease
Soy	Reduces cholesterol, reduces risk of osteoporosis, certain cancers, and heart disease	May reduce the risk of heart disease
Fruits and vegetables	Reduces risk of certain cancers and heart disease; reduces hypertension	May reduce the risk of some cancers; May reduce the risk of heart disease
Fish	Reduces cholesterol and triglycerides	None
Garlic	Reduces risk of heart disease and certain cancers, reduces cholesterol	None
Grapes/grape juice	Reduces risk of heart disease	Structure/function claim
Flaxseed	Reduces risk of heart disease and certain cancers; reduces triglycerides; increases blood-glucose control	None
Nuts	Reduces risk of heart disease	None
Enriched foods		
Grains	Reduces risk of certain cancers, heart disease, and nutrient deficiencies	May reduce the risk of some cancers; May reduce the risk of heart disease
Fortified foods		
Juices with calcium	Reduces risk of osteoporosis, reduces hypertension	Helps maintain healthy bones and may reduce risk of osteoporosis
Grains with folic acid	Reduces risk of heart disease and neural tube birth defects	May reduce risk of brain and spinal cord birth defects
Infant formulas with iron	Reduces risk of iron deficiency	None
Grains with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol and constipation; increases blood-glucose control	May reduce the risk of some cancers; May reduce the risk of heart disease
Milk with vitamin D	Reduces risk of osteomalacia and osteoporosis	Helps maintain healthy bones and may reduce risk of osteoporosis
Juices with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol, hypertension, and constipation	May reduce risk of some cancers
Enhanced foods		
Dairy products with probiotics	Reduces risk of colon cancer and candidal vaginitis; controls inflammation; treatment of respiratory allergies, diarrheal disorders, and eczema	Structure/function claim
Beverages and salad dressings with antioxidants	May support overall health	Structure/function claim
Foods and beverages containing herbal preparations	Varies with ingredients	Structure/function claim
Sports bars	Varies with ingredients	Structure/function claim
Spreads with stanol esters	Reduces cholesterol	Structure/function claim
Foods containing sugar alcohols in place of sugar	Reduces risk of tooth decay	May reduce risk of tooth decay
Eggs with omega-3 fatty acids	Reduces risk of heart disease	Structure/function claim

Health benefits of antioxidants and their food sources

Antioxidant	Health benefits	Food sources
Selenium	Helps maintain healthy hair and nails, enhances immunity, works with vitamin E to protect cells from damage. Reduces the risk of cancer, particularly lung, prostate, and colorectal.	Garlic, seeds, Brazil nuts, meat, eggs, poultry, seafood, whole grains. The amount in plant sources varies according to the content of the soil.
Beta-carotene	Keeps skin healthy, helps prevent night blindness and infections, promotes growth and bone development.	Red, yellow-orange, and leafy green vegetables and fruits, including carrots, apricots, cantaloupe, peppers, tomatoes, spinach, broccoli, sweet potatoes, and pumpkin.
Vitamin E	Acts as the protector of essential fats in cell membranes and red blood cells. Reduces risk of cancer, heart disease, and other age-associated diseases.	Peanut butter, nuts, seeds, vegetable oils and margarine, wheat germ, avocado, whole grains, salad dressings.
Vitamin C	Destroys free radicals inside and outside cells. Helps in the formation of connective tissue, the healing of wounds, and iron absorption, and also helps to prevent bruising and keep gums healthy. May reduce risk of cataracts, heart disease, and cancer.	Peppers, tomatoes, citrus fruits and juices, berries, broccoli, spinach, cabbage, potatoes, mango, papaya.

SOURCE : The American Dietetic Association And WebMD.

have potential health effects, as they may boost enzyme production or activity, which may, in turn, block carcinogens, suppress malignant cells, or interfere with processes that can cause heart disease and stroke. Phytochemical-rich foods include cruciferous vegetables (e.g., broccoli, Brussels sprouts, cauliflower, cabbage), umbelliferous vegetables (e.g., carrots, celery, parsley, parsnips), allium vegetables (e.g., garlic, onions, leek), berries, citrus fruits, whole grains, and legumes (e.g., soybeans, beans, lentils, peanuts). In the early twenty-first century, identification of the role of phytochemicals in health is an emerging area of science, and the global health community does not recommend supplementation with any specific phytochemicals [8].

Dietary habits and relation to colon (colorectal) cancer disease in Mediterranean Sea countries:

A- In Spain

The high colorectal cancer (CC) incidence areas presented an incidence between 26.9 and 30.2 cases per 100,000 citizens per year, while the rates of the low incidence areas were between 5.1 and 6.5. A total of 417 people participated (56.8% women), of whom 245 (58.8%) came from the low CC incidence area (41.2% men) and 172 (41.2%) were from the high CC incidence area (45.9% men). After adjusting the model in the logistic regression analysis, the variables related to high cancer incidence were alcohol intake, eating pasta and rice more than two days per week; eating eggs and/or omelette more than two days per week and drinking more than two litres of water per day. Frequent physical exercise related with a low CC incidence: OR 3.38 (CI: 1.30-8.84; P=0.013). Thus, the highest CC incidence is associated with alcohol intake and a high intake of water, pasta, rice, and eggs. Physical exercise regularly has a protective effect [9].

Concerning, gastric disease a multi-centre case-control study of diet and gastric cancer was carried out in 4 regions of Spain (Aragon, Castile, Catalonia and Galicia) by González et al. [10]. The authors selected 354 cases of pathologically confirmed gastric adenocarcinoma from 15 hospitals, representative of nearly all those in the study areas. A control for each case, matched by age, sex and area of residence, was selected from the same hospital as the case. Habitual diet was investigated by the dietary history method, and past diet by means of a frequency questionnaire. With respect to habitual diet, an increase in risk was associated with consumption of preserved fish, cold cuts and oleaginous fruits. A high intake of cooked green vegetables, fresh non-citrus fruit and dried fruit showed an inverse association with the risk of gastric cancer. Simultaneous intake of 2 groups of food which increase or decrease the risk of cancer strengthens the respective individual effect. The intake of protective food items seems to neutralize the effects of food items which increase risk. With reference to past diet, a possible protec-

tive effect was observed for daily consumption of fresh fruit and green vegetables.

Risk factors for colorectal cancer disease in Italy

The relationship between lifestyle factors, past medical conditions, daily meal frequency, diet and the risk of 'familial' colorectal cancer has been analysed using data from a case-control study conducted in northern Italy. A total of 1584 colorectal cancer patients and 2879 control subjects were admitted to a network of hospitals in the Greater Milan area and the Pordenone province. The subjects included for analysis were the 112 cases and the 108 control subjects who reported a family history of colorectal cancer in first-degree relatives. Colorectal cancer cases and control subjects with family history were similarly distributed according to sex, age, marital status, years of schooling and social class. Familial colorectal cancer was associated with meal frequency, medical history of diabetes (relative risk, RR = 4.6) and cholelithiasis (RR=5.2). Significant positive trends of increasing risk with more frequent consumption were observed for pasta (RR = 2.5, for the highest vs the lowest intake tertile), pastries (RR=2.4), red meat (RR = 2.9), canned meat (RR=1.9), cheese (RR=3.5) and butter (RR=1.9). Significant inverse associations and trends in risk were observed for consumption of poultry (RR = 0.4), tomatoes (RR = 0.2), peppers (RR=0.3) and lettuce (RR=0.3). Significant inverse trends in risk with increasing consumption for beta-carotene and ascorbic acid were observed (RR = 0.5 and 0.4 respectively, highest vs lowest intake tertile). So, the risk factors for subjects with a family history of colorectal cancer in first-degree relatives are not appreciably different from recognized risk factors of the disease in the general population [11].

With respect to, Food groups and risk of squamous cell esophageal cancer in northern Italy a total of 304 incident, histologically confirmed cases of squamous cell carcinoma of the esophagus (275 men, 29 women) and 743 hospital controls (593 men, 150 women) with acute, non-neoplastic conditions, not related to smoking, alcohol consumption or long-term diet modification, were interviewed during 1992 to 1997. The validated food-frequency questionnaire included 78 questions on food items or recipes, which were then categorized into 19 main food groups, and 10 questions on fat intake pattern. After allowance for age, sex, education, area of residence, tobacco smoking, alcohol drinking and non-alcohol energy, a significant increased risk emerged for high consumption of soups (OR=2.1 for the highest vs. lowest quintile), whereas inverse associations with esophageal cancer risk were observed for pasta and rice (OR=0.7), poultry (OR=0.4), raw vegetables (OR=0.3), citrus fruit (OR=0.4) and other fruit (OR=0.5). The associations with dietary habits were consistent in different strata of tobacco smoking and alcohol drinking. Among added lipids, olive oil intake showed a significant reduction of esophageal cancer risk, even after allowance for total vegetable consumption (OR=0.4), while butter consumption was directly associated with this risk (OR=2.2). The present results provide further support to the evidence that raw vegetables and citrus fruit are inversely related to the risk of squamous cell esophageal cancer and suggest that olive oil may also reduce this risk [12].

The nutrition transition in Egypt

The nutrition transition in Egypt has occurred in the context of abundant dietary energy availability, urbanisation and moderate fat intakes. The prevalence of obesity and breast cancer in adults is very high, particularly among women. The prevalence of diabetes mellitus and of hypertension parallel that of obesity and both are very high. Little information is available on physical activity, but it is likely that a large proportion of the population is quite sedentary, particularly in the cities. At the same time, rates of early childhood malnutrition remain stubbornly stable and relatively high. Public awareness of the increasing prevalence of obesity and of diet-related chronic disease is increasing, and attention has turned to documenting the problem(s) [13].

Nutrition transition in South Africa

Shifts in dietary intake, to a less prudent pattern, are occurring with apparent increasing momentum, particularly among blacks, who constitute three-quarters of the population. Data have shown that among urban blacks, fat intakes have increased from 16.4% to 26.2% of total energy (a relative increase of 59.7%), while carbohydrate intakes have decreased from 69.3% to 61.7% of total energy (a relative decrease of 10.9%) in the past 50 years. Shifts towards the Western diet are apparent among rural African dwellers as well. The South African Demographic and Health Survey conducted in 1998 revealed that 31.8% of African women (over the age of 15 years) were obese and with beast cancer (body mass index (BMI) > or = 30kg m(-2)) and that a further 26.7% were overweight (BMI > or = 25 to <30 kg m(-2)). The obesity prevalence and cancer diseases among men of the same age was 6.0%, with 19.4% being overweight. The national prevalence of hypertension in blacks was 24.4%, using the cut-off point of 140/90 mmHg. There are limited data on the population's physical activity patterns. However, the effects of the HIV/AIDS epidemic will become increasingly important [14]. It was found that, urbanisation of Africans in the North West Province is accompanied by an improvement in micronutrient intakes and status, but also by increases in overweight, obe-

sity and several risk factors associated with cancer disease. It is recommended that intervention programmes to promote nutritional health should aim to improve micronutrient status further without leading to obesity. The role of psychological strengths in preventing the adverse effects of urbanisation on health needs to be examined in more detail [15].

Eating habits in high and low socioeconomic (SES) groups in Africa is consider as one of the most powerful predictors of health status and mortality worldwide [16] .High-risk health behaviours are more common in persons of low SES (LSES). The excess mortality and morbidity associated with LSES have commonly been attributed to high-risk health behaviours including diet, smoking, lack of physical activity, and obesity [16].

In several studies, food consumption patterns and nutrient intakes have been more consistent with current dietary guidelines among people of high SES (HSES) [17]. Persons of HSES reported eating more whole meal and brown bread, more fresh fruits and vegetables, and less fatty milk, eggs, and meats [18]. HSES has also been associated with lower intakes of fat, saturated fat, and refined sugar and a higher intake of dietary fibres [18]. However, the differences in nutrient intake levels are quite small [20], and in Nordic countries SES differences in food consumption have been more evident than have differences in nutrient intake [20] most likely due to a within-food group shift in consumption. Diet quality as measured by intake of micronutrients was shown to be better among HSES communities [21].

In a study conducted in Jerusalem, Israel [22], a lower intake of vitamins was found among LSES groups. In the Scottish Heart and Health Study [23], lower antioxidant vitamin intake was common to LSES. The low intake was explained by the less frequent consumption of fresh fruit and vegetables, a finding repeated in several other studies in Europe [24].

Dietary factors and gastric cancer in Asia

Korea

To assess gastric cancer (GC) risk in relation to dietary intake in Korea, a case-control study was performed. Trained dietitians interviewed 136 patients diagnosed with GC, and the same numbers of controls were selected by matching sex, age and hospital. A significant decrease in GC risk was observed with increased intake of Baiechu kimchi (prepared with salted Chinese cabbage and red pepper, etc.), Baiechu kimchi-stew, garlic, and mushroom and soybean milk. On the contrary, a significant increase in the risk of GC was observed with increased intake of cooked rice with bean, charcoal grilled beef, pollack soup, Kkakduki (a kind of kimchi prepared with salted radish and red pepper, etc.), Dongchimi (a kind of kimchi prepared with radish and a large quantity of salt water) and cooked spinach. In food groups, increased intake of soybean products was associated with decreased risk of GC. Intake of citrus fruits rather than total fruits was shown to have a protective effect on the risk of GC, but was not significant. In this study, intake of total vegetables was shown to have a protective effect, whereas high nitrate-containing vegetables increased the risk of GC. Thus, the present study strongly suggests the risk of GC decreased with high consumption of fresh vegetables and fruits, whereas high consumption of foods rich in nitrate and carcinogenic substances produced during the cooking process increased the risk of GC [25].

The nutrition and health transition in Thailand.

Thailand has undergone social and economic transitions during the past three decades and is approaching the post-demographic transitional period. These are evidenced by an increase in life expectancy at birth of the population, and declines in the total fertility and infant mortality rates. The economic structure has also moved from agricultural to industrial. Industrial growth has surpassed that of the agricultural sector as indicated by a steady rise in the share of the industrial sector in the gross domestic product, which is greater than that of other sectors. At the same time, results from several nation-wide surveys indicate that the food consumption pattern of the population has changed considerably; Thai staples and side dishes are being replaced by diets containing a higher proportion of fats and animal meat. A shift in the proportion of expenditure on food prepared at home and that expended on purchased, ready-to-eat food, in both rural and urban settings, gives another reflection of the change in food consumption of the Thai population. The prevalence of overweight, obesity and cancer disease among children and adolescents has increased dramatically during the past 20 years and is more pronounced in children from private schools and urban communities than in those from public schools or rural areas. Among adults, results from two national surveys in 1991 and 1996 indicated that the problem of overweight and other risk factors for cancer and cardiovascular disease have increased significantly. In considering the overall causes of death among the Thai population, the leading causes are diet-related chronic degenerative diseases. Diseases of the circulatory system have become the number one cause of death in Thailand and cancer has ranked as the number three cause of death since the late 1980s [26].
In northeast Thailand, stomach cancer is not common in but the life styles of the Thai population are changing to become more Western so that information for planning control programme of stomach cancer is necessary. The highest incidence rates of this neoplasm are found in Eastern Asia,

ranging from age-standardized rates of 95.5/105 (men) and 40.1/105 (women) in Yamagata, Japan to 4.1/105 (men) and 2.1/105 (women) in Khon Kaen, Northeast of Thailand. In Thailand, the estimated age-standardized incidence rates in 1993, 1996 were 4.9/105, 4.1/105 in men and 3.0/105, 2.6/105 in women. Risk factors for stomach cancer in Thai population are unclear, but possibly include low intake of vegetables and fruits, alcohol drinking, tobacco smoking and high intake of salt. The distribution of age and sex were similar in cases and controls. In the final analysis, the factors that found to be higher risk but not statistically significant were long-term filter cigarette smoking (OR=1.9, 95%CI: 0.85-4.50), long-term alcohol consumption (OR=1.2, 95%CI: 0.51-2.60) and low intake of vegetables and fruits (OR=1.2, 95%CI: 0.74-1.96). A high intake of vegetable oil (OR=4.5, 95%CI: 1.00.-20.17) was found to be associated with increased risk, and similar tendencies were noted for pork oil (OR=1.4, 95%CI: 0.63-3.01) and jeaw prik (mainly chilly with plara broth) (OR=1.2, 95%CI: 0 .76-2.01). Thus ,the present study confirm the protective effects of a high intake of fruits and vegetables against stomach cancer development and showed a high intake of sauces to increase risk of stomach cancer as in other countries in Asia [27].

Allium vegetables and stomach cancer risk in China.

Although the incidence of stomach cancer has been declining, it remains the second leading cause of cancer death worldwide. Potential protective effects of allium vegetables against cancer have been reported by a few epidemiologic studies in Chinese populations, but the sample sizes of these studies were relatively small. The associations between allium vegetable consumption and stomach cancer in a large population-based case-control study in Shanghai (750 cases and 750 age- and gender-matched controls) and Qingdao (201 cases and 201 age- and gender-matched controls) was determined. Epidemiological data were collected by a standard questionnaire, odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using conditional logistic regression in SAS. After adjusting for matching variables, education, body mass index, pack-years of smoking, alcohol drinking, salt intake, and fruit and vegetable intake, inverse relationships with dose response pattern were observed between frequency of onion intake and stomach cancer in Qingdao (P for trend=0.02) and Shanghai (P for trend=0.04) populations. In Shanghai, negative dose-response relationships were observed between monthly intake of onions (P=0.03) or garlic stalks (P=0.04) and distal, but not cardia cancer. A negative association was also noted between intake of garlic stalks (often vs. never) and risk of stomach cancer in Qingdao (OR=0.30; 95% CI: 0.12-0.77). These results confirm the protective effects of allium vegetables (especially garlic and onions) against stomach cancer [28].

Risk factors for gastric cancer in South India

Stomach cancer is the third most common cancer in South India. A higher incidence has been reported from certain states in northern India, where potential risk factors have been identified. Similar data is available only to a limited extent from southern India. The aim of this case-control study was to evaluate the effects of lifestyle habits and dietary factors on the risk of gastric cancer in South Indians. The response rate was 100 percent. There were 64 male and 25 female patients. The male to female ratio was 2.6:1. The demographic characteristics were similar in the case and control populations. Less than ten percent of patients were below the age of 30 years. Approximately 50 percent were between 30 and 60 years of age, and the rest were over 60 years of age. Multivariate logistic regression models indicated that alcohol consumption (odds ratio [OR] 2.3, 95 percent confidence interval [CI] 1.1-4.9, p-value is 0.04) and consumption of pickled food (OR 1.8, 95 percent CI 1.2-3.9, p-value is 0.05) are independent risk factors for the development of gastric cancer. A protective effect of the consumption of pulses (OR 0.4, 95 percent CI 0.2-0.9, p-value is 0.05), showing a 55 percent reduction in risk, was also identified; this could be of use for possible control and prevention of this cancer. Tobacco chewing and cigarette smoking did not emerge as high risk factors for stomach cancer. The study showed alcohol and pickled food consumption as independent risk factors for the development of gastric cancer, while consumption of pulses were protective. Cigarette smoking did not predict an increased risk of contracting the disease [29].

In addition, Diet has been implicated in prostate cancer risk and there is evidence of risk reduction with a healthy diet. The objective of this population-based case control study was to examine whether a low fat diet rich in fruits and vegetables can reduce the risk of developing prostate cancer in Mumbai, India. A statistically significant protective effect for prostate cancer was observed for those who consumed fruits and vegetables 2 to 3 kg (OR 0.5, 95%CI 0.3-0.8) and more than 3 kg (OR 0.4, 95% CI 0.3-0.6) per week compared to those who consumed less than 2 kg per week. The linear trend for the protective effect was highly significant with increase in the consumption of fruits and vegetables (p = 0.001). Even though not statistically significant, oil/fat consumption showed an elevated risk (OR 1.7, 95%CI 0.9-3.3) for those who consumed more than 2 kg of oil/fat per month compared to those who consumed less than 1 kg. The findings from this study support the hypothesis that a low fat diet rich in fruits and vegetables may reduce the risk of prostate cancer [30].

Environmental impacts of changes to healthier diets in Europe

To identify diets with positive health impacts on the basis of generally accepted authoritative recommendations. Such healthier dietary patterns contribute to the prevention of chronic diseases like obesity, type II diabetes [31, 32], cardiovascular diseases [32, 33] and cancer[1].A summary of the scientific evidence for (causal) relationships between dietary factors and obesity, type II diabetes mellitus, cardiovascular diseases, cancer, dental disorders and osteoporosis was drawn up after a joint WHO/FAO expert consultation. Part of this summary is provided in WHO/FAO [34]. Slightly different interpretations of the evidence, different dietary patterns to start from and differences in prevalence of chronic diseases may result in European countries having slightly different population nutrition goals [34, 35]. In general, however, there is an apparent consensus among European countries, especially on the population nutrition goals that should be in place to prevent chronic diseases [34]. Such generally accepted recommendations include minimum levels of fruit, vegetable and fish intake and limits on saturated and trans fat intake (based on Health Council of the Netherlands) [1, 34, 36].

Blood selenium in Yugoslavia persons

This research was carried out to discover the some factors which could influence the relationship of serum selenium concentration and the appearance of malignant diseases. Preliminary researches taken part in Yugoslavia showed the risky low concentration of selenium in soil, food items and in serum of the examined population.

The mean serum selenium level in cancer patients and healthy control were not significantly different. But, both cancer patients and healthy controls from Barajevo have significantly lower values comparing to those living in Stari Grad. The factors identified as the most important are: living in community Barajevo, age, history of chronic disease and some dietary factors. The univariate analysis revealed that factors like cigarette smoking, alcohol consumption, and family history of malignancy and comorbid states were not important predictive factors for patient malignant disease. The multivariate analysis revealed that consumption of sugar, fat and fruit were of the highest predictive value in assessing cancer relative risk [37].

Food and risk of oral and pharyngeal cancer in Swiss

The role of specific food groups and diet variety on the risk of oral and pharyngeal cancer has been considered using data from a case-control study conducted between 1992 and 1997 in the Swiss Canton of Vaud. Cases were 156 patients (126 males, 30 females) aged under 75 (median age 56) years with incident, histologically confirmed cancer of the oral cavity and pharynx, and controls were 284 subjects (246 males, 38 females, median age 57 years), admitted to the same university hospital for a wide spectrum of acute, non-neoplastic conditions unrelated to tobacco and alcohol consumption or to long-term modification of diet. After allowance for education, alcohol, tobacco and total energy intake, significant trends of increasing risk with more frequent intake emerged for eggs (OR = 2.3 for the highest tertile), red meat (OR = 2.1) and pork and processed meat (OR = 3.2). Inverse trends in risk were observed for milk (OR = 0.4 for the highest tertile), fish (OR = 0.5), raw vegetables (OR = 0.3), cooked vegetables (OR = 0.1), citrus fruit (OR = 0.4) and other fruits (OR = 0.2). The addition of a serving per day of fruit or vegetables was associated with an about 50% reduction in oral cancer risk. The most favourable diet for oral cancer risk is therefore given by infrequent consumption of red , processed meat , eggs and, most of all, frequent vegetable and fruit intake. Diet diversity was inversely related to oral and pharyngeal cancer: ORs were 0.35 for the highest tertile of total diversity, 0.24 for vegetable and 0.34 for fruit diversity. In terms of attributable risk, high meat intake accounted for 49% of oral and pharyngeal cancers in this population, low vegetable intake for 65% and low fruit intake for 54%.C- Interactions between smoking and other exposures associated with lung cancer risk in Czech Republic [38].

Protective effects were observed for intake of milk/dairy products (OR=0.57, 95%CI 0.35-0.94), vegetables (OR=0.60, 95%CI 0.40-0.91), apples (OR=0.69), wine (OR=0.77), and physical exercise (OR=0.59, 95%CI 0.42-0.83) among smokers only, while no similar effects were found among non-smokers. In contrast, the intake of black tea was associated with a protective effect (OR=0.66, 95%CI 0.47-0.94) among non-smokers only. Comparing the effects of dietary items and physical activity on lung cancer risk among non-smokers versus smokers, statistically significant effect modifications were found for black tea (P 0.005), and milk/dairy products (P 0.047). Borderline effect modifications emerged for physical exercise (P 0.077) [39].

Vegetables and fruits and risk of stomach cancer in Lithuania

Stomach cancer is the second common cause of death in Lithuania and most countries of the world. Nevertheless, there were no reports of epidemiological studies on stomach cancer in Lithuania. Therefore, a hospital-based case-control study has been carried out in order to assess the associations between vegetables and fruits and risk of stomach cancer after adjustment for other food items (vegetables, fruits, different types of meat, processed meat and fish, dairy

and starchy products, coffee, green tea), that were related to outcome, smoking, alcohol use, family history on cancer, education level and residence, stomach cancer risk was inversely associated with consumption of raw vegetables such as cabbage (OR=0.24; 95% CI=0.10-0.57; > or =1-3 times/month vs. almost never), carrots (OR=0.42, 95% CI=0.20-0.86; 1-6 times/week vs. almost never) and garlic (OR=0.59, 95% CI=0.37-0.96; 1-6 times/week vs. almost never). Protective effect has been observed for intake of broccoli (OR=0.52, 95% CI=0.28-0.98; 1-4 times/week vs. < or =1-3 times/month). There were no statistically significant associations between stomach cancer risk and consumption of citrus or others fruits. Thus, the higher consumption of raw vegetables such as cabbage, carrots, garlic as well as broccoli may decrease a risk of stomach cancer, whereas intake of citrus fruits has no relation with a reduced risk of the disease. In conclusion, higher risk of gastric cancer is found for people that like salty food, salt-preserved meat as well as fish [40].

low-fat diet for breast cancer prevention in U.S.

It was found that the changes in dietary behaviour was correlated significantly with objective changes in body weight and fasting cholesterol in healthy women encouraged to consume a low-fat diet for prevention of breast cancer [41].

Dietary beta carotene and lung cancer risk in U.S.

Approximately 15% of all lung cancer deaths in the United States (about 22,350 deaths annually) may not be directly attributable to active cigarette smoking. Consumption of beta carotene, which is derived almost exclusively from intake of fruits and vegetables, has been associated with a reduced risk of lung cancer in smokers. However, studies examining this association in nonsmokers, particularly nonsmoking men, are limited .It was found that consumption of greens (P for trend < .01), fresh fruits (P for trend < .01), and cheese (P for trend < .05) was associated with a significant dose-dependent reduction in risk for lung cancer, whereas consumption of whole milk (P for trend < .01) was associated with a significant dose-dependent increase in risk. Use of vitamin E supplements was also protective (odds ratio = 0.55; 95% confidence interval [CI] = 0.35-0.85). Increased consumption of the following food groups was associated with a reduction in risk among females: vegetables (P for trend < .025), raw fruits and vegetables (P for trend < .005), and dairy products (P for trend < .025). In males, increased consumption of raw fruits and vegetables was associated with a reduced risk for lung cancer (P for trend < .005). Dietary beta carotene (OR = 0.70; 95% CI = 0.50-0.99), but not retinol (OR = 0.98; 95% CI = 0.82-1.17), was significantly associated with risk reduction. Thus, dietary beta carotene, raw fruits and vegetables, and vitamin E supplements reduce the risk of lung cancer in nonsmoking men and women [42].

Food groups and renal cell carcinoma in Florida

The reduction in renal cell carcinoma risk was observed among the total sample and for men for vegetable consumption (all subjects: OR 0.56, 95% CI 0.35, 0.88; men: OR 0.49, 95% CI 0.25, 0.96) but not for fruit consumption. Tomato consumption decreased renal cell carcinoma risk for the total population and for men (all subjects: OR 0.50, 95% CI 0.31, 0.81; men: OR 0.47, 95% CI 0.24, 0.95). Increased risk of renal cell carcinoma was observed among all subjects and among women with increased consumption of red meat (all subjects: OR 4.43, 95% CI 2.02, 9.75; women: OR 3.04, 95% CI 1.60, 5.79). White bread consumption increased renal cell carcinoma risk among women only (OR 3.05, 95% CI 1.50, 6.20), as did total dairy consumption (OR 2.36, 95% CI 1.21, 4.60). So, the protective role of vegetables and the increased risk of renal cell carcinoma with meat consumption are supported. The protective role of fruits is not. Novel findings include the increased risk of renal cell carcinoma with white bread and white potato consumption and the decreased risk of renal cell carcinoma with tomato consumption [43].

Diet as a risk factor for gastric cancer in Hawaii

Cigarette smoking, family history of gastric cancer and personal history of gastric ulcer were positively associated with gastric cancer, while education and past use of non-steroidal anti-inflammatory drugs were inversely related to risk. The consumption of all vegetables, mainly dark green, light green and yellow vegetables, reduced risk. Many of these vegetables contain beta-carotene, vitamin C, vitamin E or folate, which were also inversely related to gastric cancer risk. When these nutrients were analyzed simultaneously, the inverse association was mainly with beta-carotene. The intake of processed meats and bacon was positively associated with gastric cancer risk, but primarily in men. When we simultaneously adjusted these meats for the intake of the different vegetables, the association was no longer significant. These findings provide additional support that the consumption of dark green and yellow vegetables is protective against adenocarcinoma of the distal stomach [44].

Nutrition transition in South of America

Chile

As malnutrition decreased during the 1980s, obesity increased rapidly in all age groups. In adults, currently about 25% of women are obese and with different types of can-

cer (body mass index >30 kg m (-2)); particularly those from low socio-economic levels. Among preschoolers, obesity is now 10% while in 6-year-old children it is 17.5% (weight/height greater than two standard deviations (>2SD) of the World Health Organization reference). Nutritional risk factors are prevalent, diet is changing to a 'Western diet' with an increasing fat consumption, and sedentarianism is constant in all groups. High blood pressure (>140/90) is greater than 10% in adults. Diabetes is increasing in urban areas, including in the indigenous population, and more than 40% of adults have a cholesterol level of more than 200 mg ml (-1). So, promotion of healthy lifestyles is the main strategy to cope with this situation, particularly changing behaviour in food habits, physical activity and psychosocial factors. Changes in lifestyles will not only allow the prolonged life expectancy to be of better quality, but also will favour a decrease in the morbidity and mortality from chronic diseases, mainly cardiovascular diseases [45].

Dietary patterns and risk of gastric cancer in Uruguay.

Gastric cancer is a frequent malignancy in the Uruguayan population. In northern counties, incidence rates reach high figures (age-standardized rates [ASR], 37.3 per 100,000 men and 18.3 per 100,000 women). Diet is a major determinant in gastric carcinogenesis. Because foods or food groups have the advantage over nutrients in being most directly related to dietary recommendations, the authors decided to conduct a case-control study on the relationships between food groups and risk of gastric cancer. For this purpose, the study included 240 cases and 960 controls. The individual analysis of food groups showed increased risks of gastric cancer for rice, salted meat, stewed meat, white bread, potatoes, and tubers. On the other hand, raw vegetables, total fruits, legumes, and black tea were inversely associated with risk of gastric cancer. All three dietary patterns, generated by factor analysis, were significantly associated with gastric carcinoma risk. Whereas the starchy factor was directly associated with gastric cancer, the healthy and mixed patterns were strongly protective. Finally, the risk enhancing empirical score displayed an increased risk of gastric cancer (odds ratio [OR], 4.1, 95% confidence interval [CI], 2.6-6.6), whereas the protective score showed an important reduction in risk, of 0.38. Hence this study displayed consistent results from three different approaches. Concerning different food groups, stewed and processed meat are rich in salt; rice, tubers, and winter squash are sources of starch; and vegetables and fruits are rich in ascorbic acid and carotenoids. All these substances have been strongly related to gastric carcinogenesis. Furthermore, this study suggests that diets rich in vegetables and fruits and with low amounts of salty and starchy foods are recommendable for the prevention of gastric cancer[46] .With respect to other cancer types , higher intake of fruits and vegetables combined was associated with a decreased risk of cancers of the esophagus (odds ratio, OR= 0.63, 95% CI: 0.42-0.97), lung (OR= 0.75, 95% CI: 0.57-0.98), breast (OR= 0.47, 95% CI: 0.31-0.71), prostate (OR= 0.63, 95% CI: 0.44-0.92) and all sites combined (OR= 0.73, 95% CI: 0.61-0.87). When evaluated separately, fruit intake was more strongly associated with decreased cancer risk than vegetables. These inverse associations were mainly observed in men, among persons with high intake of meat, alcohol drinkers and among smokers [46].

Risk factors for stomach cancer in Brazil

Frequent consumption of beef was associated with increased risk: odds ratio (OR) = 4.0 and 95% confidence interval (CI) = 1.9-8.4 for daily consumption, OR = 2.1 and 95% CI = 1.0-4.3 for 3-4 days/week) when compared with the category of lower consumption (<3 days/week) after adjustment for country of birth (Japan or Brazil), showing a dose-response pattern (P for trend = 0.001). These ORs became higher after further adjusted for fruit consumption: OR = 4.4, 95% CI = 2.1-9.4 and OR = 2.4 and 95% CI = 1.1-5.0, respectively. Daily consumption of fruit was associated with a reduction in risk (OR = 0.5, 95% CI = 0.3-1.0) after adjustment for country of birth and became statistically significant further adjusted for beef consumption (OR = 0.4, 95% CI = 0.2-0.9). There were no statistically significant associations with smoking or any other factors tested. Although some attenuation was observed in beef consumption, the observed associations were similar after excluding volunteer controls. Thus, the daily beef consumption among immigrants and their descendants may be associated with stomach cancer risk. The protective effect of fruit consumption was confirmed in this population [47].

Disparities in colorectal cancer in African-Americans vs Whites

There are differences between African-American and white patients with colorectal cancer, concerning their characteristics before and after diagnosis. Whites are more likely to adhere to screening guidelines. This is also the case among people with positive family history. Colorectal cancer is more frequent in Blacks. Studies have shown that since 1985, colon cancer rates have dipped 20% to 25% for Whites, while rates have gone up for African-American men and stayed the same for African-American women. Overall, African-Americans are 38% to 43% more likely to die from colon cancer than are Whites. Furthermore, it seems that there is an African-American predominance in right-sited tumors. African Americans tend to be diagnosed at a later stage, to suffer from better differentiated tumors, and to have worse prognosis when compared with Whites. Moreover, less black patients receive

adjuvant chemotherapy for resectable colorectal cancer or radiation therapy for rectal cancer. Caucasians seem to respond better to standard chemotherapy regimens than African-Americans. Concerning toxicity, it appears that patients of African-American descent are more likely to develop 5-FU toxicity than Whites, possibly because of their different dihydropyridine dehydrogenase status. Last but not least, screening surveillance seems to be higher among white than among black long-term colorectal cancer survivors. Socioeconomic and educational status account for most of these differences whereas little evidence exists for a genetic contribution in racial disparity. Understanding the nature of racial differences in colorectal cancer allows tailoring of screening and treatment interventions [48].

Food groups and relation to colon cancer risk in African-Americans and Caucasians.

The disparities in colon cancer incidence between African-Americans and other U.S. ethnic groups are largely unexplained. This report examines associations of various food groups with colon cancer in African-Americans and Caucasians from a case-control study. Incident cases of histologically confirmed colon cancer, age 40-80 years, (n = 613) and matched controls (n = 996) were interviewed in-person to ascertain potential colon cancer risk factors. Diet over the year before diagnosis or interview date was assessed using a validated food frequency questionnaire adapted to include regional foods. Multivariate logistic regression models estimated energy-adjusted and non-energy adjusted odds ratios (OR). Controls generally reported higher consumption (daily amount and weekly frequency) of fruits, vegetables and dark green, deep yellow fruits/vegetables, whereas cases consumed more refined carbohydrates and fats, oils and snacks. Regardless of ethnic group or energy adjustment, high and frequent vegetable consumption (particularly dark green vegetables) was protective, consistent with 20-50% reductions in risk. In Caucasians, high refined carbohydrate and red meat consumption (amount and frequency) was associated with a statistically significant 2-fold increased risk in non-energy adjusted models. In African-Americans, frequent intake of dairy foods was associated with a doubling in risk (OR = 1.9, 95% CI = 1.1-3.4) in non-energy-adjusted models, whereas frequent fruit consumption correlated with a non-significant 30% lower risk. These findings add to growing evidence that plant foods may protect against colon cancer; however, the effects of the other food groups varied by ethnic group and energy adjustment. These results may also explain some of the ethnic differences in colon cancer incidence [49].

The Relationship between Diet, Physical Activity, and Cancer

While the exact mechanisms by which diet is related to cancer have not been completely understood, research has shown that food plays a role in cancer prevention. For example, populations whose diet includes at least five servings of fruits and vegetables a day have lower rates of some of the most common cancers. Fruits and vegetables contain many antioxidants and phytochemicals, such as vitamins A, C, and E, and beta-carotene, which have been shown to prevent cancer. It is not completely clear, however, whether it is individual phytochemicals, or a combination of them, or the fiber in fruits and vegetables that result in reduced risk of cancer [50].

Studies have shown the risk of prostate cancer drops for men who eat tomato products, possibly because of the phytochemical lycopene. In addition, it has been shown that colon cancer declines among those who drink green tea, which contains antioxidants and phytochemicals, and who regularly, eat soy products and foods rich in selenium, an antioxidant [30]. Those who eat a diet low in fat, especially animal fat, also have lower cancer rates, but again it is not clear whether it is the calories, the amount and distribution of body fat, or the likelihood that a low-fat diet is high in fiber, fruits, and vegetables that is protective against cancer. High-fiber diets are thought to reduce the risk of colon cancer because the fiber helps move food through the lower digestive tract, possibly reducing the contact of any carcinogens with the bowel lining [2].

Scientific evidence indicates that physical activity may reduce the risk of certain cancers. This effect may be due to the fact that physical activity is associated with the maintenance of a healthy body weight. Other mechanisms by which physical activity may help to prevent certain cancers may involve both direct and indirect effects. For colon cancer, physical activity accelerates the movement of food through the intestine, thereby reducing the length of time that the bowel lining is exposed to potential carcinogens. For breast cancer, vigorous physical activity may decrease the exposure of breast tissue to circulating estrogen , a hormone that has been implicated in breast cancer. Physical activity may also affect cancers of the colon, breast, and other sites by improving energy metabolism and reducing circulating concentrations of insulin and related growth factors [3].

Because of these factors, recommendations of the American Cancer Society to reduce the risk of cancer include: consump-

tion of a mostly plant-based diet, including five or more servings of fruits and vegetables each day; consumption of whole grains in preference to processed or refined grains and sugar; limited consumption of high-fat foods, particularly from animal sources; physical activity; and limited consumption of alcohol [1].

The mechanisms by which Diet lower cancer risk

Some foods actually contribute to the development of cancer; other foods lessen the risk. The following anti-cancer diet greatly lowers risk of colorectal cancer and nearly all other types of cancers. It can also prevent cardiovascular disease. For people with a genetic tendency toward colorectal cancer, it is not just an option; it's a lifesaving necessity [50].

There are at least two ways in which dietary fat contributes to cancer. First, tumor cells need low density lipoproteins (LDL's) to grow. Therefore, a diet that helps to lower LDL levels could keep potentially cancerous cells from growing. Eating fat also stimulates the production of bile, which is needed to digest fat. If a lot of bile is allowed to stagnate in the large intestine for a long period of time, it's converted into apcholic acid, a proven carcinogen. Here are tips for eating not only less fat, but eating the right fats, such as seafood which is rich in omega 3 fatty acids and the Mediterranean diet (which is plant-based, but high in monounsaturated oils). Some fats don't contribute to cancer and may in fact have some anticancer properties: Unsaturated fats, found in plant foods, such as legumes. Vegetable oils that are high in monounsaturated fats, such as olive (Greek women who tend to eat a diet rich in olive oil have a very low incidence of breast cancer) and canola oil. In addition, men who eat less animal fat and more vegetable fat in their diets had less prostate cancer. Seafood, such as salmon and tuna, that is high in omega 3 fatty acids , significantly decreased colorectal tumors and breast cancer (It is thought that omega 3 fatty acids may block the effect of estrogen on breast cells, thus lowering the risk of them becoming cancerous) . Oils that contain more omega 3 than omega 6 fatty acids, such as flaxseed, pumpkin seed, canola, soybean (not hydrogenated), walnut, safflower, sunflower, sesame, and virgin olive oils. (Heating vegetable oils at high temperatures can change fatty acids and make them carcinogenic. Peanut oil and extra virgin olive oil stand up best to cooking, but not to boil. It helps to keep stirring stirfrys so the oil doesn't get burnt) [51].

Bad fats (saturated fats), such as palm, palm kernel, coconut, and cottonseed oils. Hydrogenated fats (those that have been chemically changed from unsaturated to saturated fats), are potentially carcinogenic. Adding hydrogen to a fat molecule may enable the molecule to interfere with the normal metabolism of cells in the body, setting the cell up for cancerous changes. So get used to reading labels. If any food contains "hydrogenated" or "partially hydrogenated" fats, leave it on the shelf. Most fast-food outlets use hydrogenated fats. (Ask! If they do, don't eat the food.) Nearly all packaged foods, such as potato chips, contain hydrogenated fats, since these allow a longer shelf life [52].

Too much body fat is one of the leading risk factors for cancer, especially colorectal cancer. Obesity is also a risk factor for breast cancer; increased fat tissue raises circulating estrogen levels, which increase the risk of breast cancer. Vegetarian women who typically consume a low-fat, high-fiber diet tend to have lower blood levels of estrogen, excrete more estrogen in their stools, and therefore are less prone to breast cancer. Obese men have a higher rate of prostate cancer. The two ways to stay lean are to exercise and to maintain healthy eating habits [53, 54].

Fiber Intake. In all the research between food and cancer, the evidence for a relationship between a high fiber diet and lower chances of colorectal cancer is the most conclusive. It follows common sense as well. Fiber moves potential carcinogens through the intestines faster, decreasing the contact time between carcinogens and the intestinal wall. The less exposure to carcinogens, the less chance of colon cancer. Besides pushing them through faster, fiber binds carcinogens, keeping them away from the intestinal wall. Fiber also absorbs bile acids, keeping them from acting on bacteria to produce fecapentanes, the cancerous substances that are formed by decaying foods within the colon. There are about twenty of these compounds that can mutate colon cells into cancerous cells. Fiber also promotes the growth of healthy bacteria in the intestines, which crowd out the undesirable bacteria that produce fecapentanes. A low intake of fiber also increased the risk of developing colon cancer.A high fiber diet seems particularly protective against cancer in persons who have a hereditary risk of developing precancerous colorectal polyps. In a study of persons who were at high risk for developing colorectal cancer, those who ate at least thirteen grams of wheat bran fiber a day (All-Bran is a good source) for eight weeks showed less growth of potential cancer cells in the colon. Besides lowering the risk of colorectal cancer, a high fiber diet can lower the risk of breast cancer by binding estrogen in the bowels, thereby lessening the estrogen effect in the cells of breast tissue [55].

Based on both these scientific and common sense findings, it was suggested that at least 25 grams of fiber per day must be obtained. Best anticancer fiber sources are: wheat bran, kidney beans, garbanzo beans, navy beans, whole wheat, whole grains, legumes, whole grain bread, and prunes. Get used to looking at the package label to find the fiber content of foods. Simple modifications in the diet can increase the amount of fiber . Use whole grain breads instead of white

bread (white bread is junk bread). Eat beans regularly (try a salad composed of kidney beans, garbanzo beans, broccoli, and other raw vegetables). Have a big bowl of high fiber bran cereal for breakfast. An Apple a Day May Keep the Cancer Doctor Away .Pectin, the fiber in apple skin, is fermented in the intestines, producing short-chain fatty acids that prevent the growth of harmful bacteria. They also nourish the cells of the intestinal lining, making them more resistant to becoming cancerous [4, 7].

Raw fruits and vegetables. The consensus of the hundreds of studies exploring the link between diet and cancer is that eating more fruits and vegetables reduces the risk of all types of cancers. Eating more fruits and vegetables decreases the appetite for fatty foods, which themselves increase the risk of cancer. Plants also contain phytochemicals . Substances that may help the body fight cancer. The five major classes of compounds that occur in fruits and vegetables as natural blocking agents against carcinogens are: phenols, indols, flavones, cumines, and isothiocyanates. These neutralizing agents prevent carcinogens from reaching critical target sites within the cell. The vegetables most important to reducing the risk of cancer are the cruciferous vegetables: broccoli, cabbage, brussel sprouts, mustard greens, kale, and cauliflower. These vegetables contain three cancer-protective biochemicals: sulforaphane, which not only boosts immunity but blocks enzymes that draw carcinogens into healthy cells; compounds that prevent the formation of carcinogenic nitrosamines in the intestines; and indoles, which lessen the risk of breast cancer. No association was found between the risk of colon cancer and vegetable fat or linoleic acid (the most abundant polyunsaturated fat) in the diet [56].

The observed enhancement level in case of Brassica vegetables was due to its content ofglucosinolates, flavonoids and other phenolics. The anticarcinogenic activity is related to the presence of biologically active components that modulate the activity of phase I and II detoxification enzymes and other mechanisms triggered by glucosinolates, which are formed as a result of hydrolysis and catalyzed by the enzyme myrosinase. The presence of indole-3-carbinol (I3C) and its metabolite bis (3'-indolyl) methane (DIM) induce growth inhibition and antiangiogenic activities. The mechanisms of these responses are complex and dependent on cell context. I3C and/or DIM activate or inactivate multiple nuclear receptors, induce endoplasmic reticulum stress, decrease mitochondrial membrane potential, and modulate multiple signalling pathways including kinases [57].

Researchers estimate that eating lots of cruciferous vegetables could lower the risk of breast and colon cancer by 40 percent. By making the main meal, such as lunch, a huge salad (with no more than a tablespoon of vegetable oil as a dressing) would be one of the healthiest habits you could get into. Best salad sources of anti-cancer nutrients are: dark green leafy spinach (instead of iceberg lettuce, which is nutritionally useless), broccoli, tomatoes, red peppers, kidney beans, and garbanzo beans. As an added benefit sprinkle your salad with a bit of garlic, which has also been shown to have health-promoting and possibly anti-cancer properties. In addition, phytoestrogens from plant foods, especially cruciferous vegetables, can lower the risk of estrogen-dependent cancers, such as breast cancer. The phytoestrogens fill estrogen receptor sites on cells, keeping the cancer-causing estrogen from promoting the growth of malignant cells. Antioxidants, such as vitamin C and E and beta carotene, seem to have a synergistic effect when taken together. So, eating lots of fruits and vegetables in a salad together produces a greater anti-cancer effect than eating each one individually [58].
Switch from red meat to seafood. Populations who eat the most red meat and fat in their diet have the highest incidence of colon cancer. Eating steaks, cheeseburgers, and French fries was not worth the price of getting cancer. Instead of red meat being the main course, let it be an accent in a dish based on vegetables or grains, such as stirfry or pasta [55].
Beginning in 1976 a group of researchers at the Harvard School of Public Health set out to study the role of dietary factors in colon cancer and test some of the theories suggested by earlier studies. They followed 88,000 healthy women, ages 34 to 59 years of age, and discovered these correlations:

- The risk of colon cancer was 2.5 times higher in women who ate beef, pork, or lamb as a main dish every day, as compared with those eating it less than once a month.
- The risk of developing colon cancer correlated with the amount of animal fat in the diet.

Eating meat, especially processed meats, was highly associated with increased risk of colon cancer. Eating fish and chicken without skin was related to a decreased risk [54, 56].

The reason for the red meat-colon cancer connection is still being studied. Current research suggests a combination of factors. High fat diets increase the excretion of intestinal bile acids, which act as tumor promoters. Some processed meats contain nitrosamines, which can be carcinogenic to the colon. Also, compared with vegetarians, meat-eating persons have different colonic flora. The effects of the meat may cause intestinal bacteria to transform bile acids into potential carcinogens .Not only can red meat itself be carcinogenic, but how you prepare it can also elevate the cancer risk. Grilling under high heat (such as searing or flame-cooking meat to well- done) can release carcinogens into the meat called heterocyclicamines, which can damage cellular DNA. Poaching, stewing, microwaving, or slow low-heat cooking releases fewer carcinogens [59].

Switch from an animal-based diet to a plant-based diet. The most compelling research linking diet to cancer is studies of groups of people who have primarily plant-based diets, for example vegetarians and Seventh Day Adventists, and who have a much, lower risk of cancer. One of the theories on the high incidence of cancer in modern times is the belief that the switch from plant based to animal based diets correlates with the increase in cancer. Plant food / less cancer correlation is primarily due to three health-promoting factors: Plants have less fat, more fiber, and more phytonutrients. Besides providing the anti-cancer properties of fiber, legumes (such as seeds, rice, soy beans, beans, and chick peas) contain anticancer properties called protease inhibitors, which have been shown to reduce the growth of breast, colon, and skin cancers in experimental animals [57, 60].

Soy products. Soy is a more healthful source of protein than meat. The primary anti- cancer value of soy seems to come from phytonutrients (for example, isoflavones) which inhibit the growth of new blood vessels necessary for tumor survival. Soy also protects against colon cancer by blocking the carcinogenic effects of bile acids (a process called angiogenesis). Isoflavones also help regulate the production of sex hormones, which could affect the risk of prostate and breast cancer. Studies have shown that women who eat more soy foods have less risk of breast cancer. Don't rely on highly-processed soy foods, such as soy burgers, soy sauce, and soy beverages to contain a lot of cancer-fighting isoflavones [61].

American women, especially those whose diets are low in soy products, are four times more likely to die of breast cancer than Japanese women whose diets are plentiful in soy. The reason this reduced risk is contributed mainly to the soy and not to the genes is that even in their own country those Japanese who eat the most soy foods get the least cancer. Soy seems to protect against the most common types of cancer, including lung, rectal, colon, stomach, prostate, and breast. Experimental animals who are fed high soy diets and then given a chemical that causes cancer, develop fewer tumors than the animals who are not fed soy. And you don't need to eat much to reap the benefits. One serving of soy (equal to a 1/2 cup of cooked soybeans, tofu, tempeh, or one cup of soy milk) a day can lessen the risk of cancer [16].

Foods containing calcium. Studies have shown that populations with a high intake of calcium (e.g., people in Sweden) have a lower incidence of colorectal cancer. Calcium controls the multiplication of epithelial cells lining the colon. When these cells proliferate at a fast rate, the risk of cancer increases. Calcium also binds cancer-producing bile acids and keeps them from irritating the colon wall. One study showed that an average intake of 1,200 mg. of calcium a day was associated with a 75 percent reduction in colorectal cancer. In another study of persons with an increased risk of colorectal cancer, a daily supplement of 2,000 mg. of calcium carbonate significantly decreased the risk by suppressing the uncontrolled growth of the cells that line the colon. To lower your risk of colorectal cancer, consider taking between 500 and 1,000 milligrams of calcium carbonate or calcium citrate daily, depending on how much calcium you get from food each day. Best sources of calcium are dairy products, such as yogurt, and bony fish [18].

Diet high in antioxidants. While there are many unsubstantiated claims about the benefits of antioxidants, there is reliable scientific evidence that beta carotene, vitamin C and vitamin E definitely lower the risk of colorectal cancer. Fruits and vegetables are the main sources of these naturally occurring antioxidants. Antioxidants protect against cancer in several ways:

- They protect the membrane of intestinal cells.
- They prevent free-radical reactions that can cause bowel contents to be carcinogenic
- They prevent faulty metabolism in the cell, which can predispose a cell to becoming carcinogenic.

Beta carotene. Beta carotene fights against cancer by both boosting the immune system and releasing a specific chemical called tumor necrosis factor. Beta carotene can block the growth of potentially cancerous cells. The recommended cancer prevention dose of beta carotene is 15 to 25 mg. per day (around 30,000 IU). This is about ten times the amount in the average American diet, but it's actually easy to get enough beta carotene in your diet without taking supplements. Best sources of beta carotene are sweet potatoes, carrots, cantaloupe, pumpkins, butternut and other types of winter squash, spinach, broccoli, mango, and papaya. Eating pink grapefruit (which contains beta carotene) instead of white grapefruit gives you a beta carotene boost. You could get enough protective beta carotene each day by eating: half a sweet potato, half a cup of pumpkin, two medium-size carrots, 1.5 cups of cooked spinach, or two medium-size mangos. Best sources of beta carotene are these:

- carrots - 1 carrot contains 4.4 milligrams
- sweet potatoes - 1 medium contains 12 milligrams
- butternut and other types of winter hard-shell squash - 1/2 cup contains 2.4 milligrams

Tomatoes contain lycopene, which enhances the absorption and utilization of beta carotene, so eating tomatoes with beta carotene-rich foods provides an added boost. Carrots and tomatoes are a good combination [4, 62].

Vitamin C. A big dose of vitamin C fights the big "C." Studies have shown that persons with the highest intake of vitamin C have the lowest incidence of intestinal cancers. Vitamin C blocks the formation of nitrosamines in the gut. These are potent carcinogens made from nitrates and nitrites found in food, especially processed meats. Vitamin C also boosts the immune system by increasing the production of lymphocytes. Best sources of vitamin C are fresh fruits and vegetables. Taking 1,000 to 2,000 milligrams of vitamin C daily may have anticancer benefits [63].

Vitamin E. The anti-cancer properties in vitamin E are similar to vitamin C. In a ten-year study that followed 21,000 men, those with high levels of vitamin E in their diet showed a 30 percent lower risk of all types of cancer. Women with low blood levels of vitamin E and selenium had ten times the risk of breast cancer in one study. In another study at the University of Toronto, researchers gave colon cancer patient's vitamin C and E supplements after surgery and found two years later that the supplements reduced the recurrence of precancerous colon polyps by 20 percent. Studies suggest a dose of 200 to 400 IU a day, which is nearly impossible to get from foods. You may get less than ten percent of this amount from even the best diet [64].

Flax. Flaxseeds contain two cancer-preventive compounds: omega 3 fatty acids and lignans, which may reduce the risk of breast cancer and colon cancer. Ground flaxseeds, because they contain both the fiber and the oil, have more potent anticancer properties than flax oil alone. Cancer researchers suggest 25 grams of ground flaxseeds a day. You can grind your own in a coffee grinder or purchase pre-ground flaxseed meal, which mixes well in smoothies or sprinkled like bran flakes over yogurt [61].

Alcohol. Alcohol consumption slightly increases the risk of colorectal cancer, and the alcoholic beverage with the strongest link to colon cancer is beer. Beer is thought to contain nitrosamines, a carcinogen or pre-carcinogen that is activated in the intestines. Tannins are a carcinogenic compound that is found in red wine and some coffee and tea. While red wine is touted to have health-promoting properties, due to the natural phytonutrients that are found in the grape skin, you're better off simply eating the grapes [4, 16].

Other anti-cancer nutrients. Increasing several other daily nutrients can also lower your risk of cancer [65].

Vitamin D. Vitamin D, which you get from exposure to sunshine (around 10 to 15 minutes a day) and from vitamin D-fortified milk and other foods, has anticancer properties. It suppresses angiogenesis, the formation of new blood vessels that nourish the growth of tumors. The rates of breast, prostate, and colon cancer are lower in climates that have the most sunshine. Low levels of vitamin D have been found in some people with colon cancer. Women whose diets are high in vitamin D have a lower risk of breast cancer [4].

Selenium. This overlooked mineral is a potent antioxidant or scavenger of carcinogenic free radicals. Studies have shown a lower incidence of colon cancer in people taking selenium supplements in the range of 100 to 200 mcg a day. Studies have shown that persons who have lower levels of selenium in their blood are more likely to have colon polyps, and those with higher levels of selenium have much less of a chance of getting cancer. Selenium is most effective when taken along with foods or supplements that are high in vitamin E. Consider taking 100 mcg of selenium a day as a supplement. Best sources of selenium in food are fish (especially red snapper) lobster, shrimp, whole grains, and vegetables, depending on the selenium content of the soil they're grown in. Other sources include: brown rice, cottage cheese, lamb-chops, chicken (white meat), sunflower seeds, and garlic [37].

Acidophilus. These intestinal-friendly bacteria have been shown to have anti-cancer properties. They promote the growth of healthy bacteria in the colon and reduce the conversion of bile acids into carcinogens. Studies have shown that consuming dietary supplements of lactobacillus acidophilus greatly diminishes the level of colon enzymes that produce carcinogenic decomposition products from food. In studies on experimental animals, 75 percent of the animals tested showed slower tumor growth when fed yogurt containing live bacterial cultures [4].

Garlic. Whether or not garlic has health-promoting and anti-cancer properties is still controversial, but it's possible that garlic may have some anticancer benefits. The Kyolic brand of garlic supplements seems to be the most thoroughly tested and the one that is often used in research studies [4].

Green tea. Green tea has been shown to inhibit the growth of cancer cells, possibly because of a phytochemical it contains called "catechins" [4].

Effect of regular consumption of apples on colorectal cancer risk in a population with relatively low intake of fruits and vegetables.

Laboratory in-vitro studies and animal experiments showing the potential health benefits from apples raises the question to what extent the regular consumption of apples in humans may have a beneficial effect on colorectal cancer risk. Apples were the most frequent fruit consumed by the study participants and about 80% of variability in the total fruit consumption resulted from the intake of apples. The au-

thors did not observe any significant statistical differences in consumption of berries, citrus, or stone fruits and other kinds of fruits across cases and controls. The adjusted estimates of colorectal cancer risk related to the daily consumption of apples (in quintiles) were based on the unconditional multivariate logistic model, which considered the set of potential confounding variables such as demographic characteristics of participants (age, gender, place of residency, marital status, tobacco smoking), total energy intake, intake of vegetables and fruits without apples. The results of the logistic analysis showed that the adjusted risk of colorectal cancer inversely correlated with daily number of apple servings. The reduced risk of colorectal cancer of border significance level was already observed at the consumption of at least one apple a day (odds ratio=0.65, 95% CI: 0.39-1.09), but at the intake of more than one apple a day the risk was reduced by about 50% (odds ratio=0.53, 95% CI: 0.35-0.79). Neither the consumption of vegetables nor other fruits have shown beneficial effects on the risk of colorectal cancer. The observed protective effect of apple consumption on colorectal risk may result from their rich content of flavonoid and other polyphenols, which can inhibit cancer onset and cell proliferation [66].

Summary and Recommendation

Great progress has been made in the fight against cancer, and cancer detection and treatments have improved significantly. However, there is a disparity in cancer death rates between developed and developing countries. Between 80 and 90 percent of cancer patients in developing countries have late-stage and often incurable cancer at the time of diagnosis.

People with cancer often have increased nutritional needs. As such, it is important for them to consume a variety of foods that provide the nutrients needed to maintain health while fighting cancer. These nutrients include: protein, carbohydrates, fat, water, vitamins, minerals and micronutrients. Diets rich in vegetables, fruits and with low amounts of salty and starchy foods are recommendable for the prevention of gastric cancer. Nutrition suggestions for people with cancer often emphasize eating high-calorie, high-protein foods. Protein helps to ensure growth, repair body tissue, and maintain a healthy immune system. Therefore, people with cancer often need more protein than usual.

The recommendations of the American Cancer Society to reduce the risk of cancer include, consumption of a mostly plant-based diet, including five or more servings of fruits and vegetables each day; consumption of whole grains in preference to processed or refined grains and sugar; limited consumption of high-fat foods, particularly from animal sources; physical activity; and limited consumption of alcohol.

A growing body of evidence shows that simple changes in diet and lifestyle can help prevent many cancers. Further research into the exact mechanisms by which certain diets may help prevent cancer is ongoing. The role of psychological strengths in preventing the adverse effects of urbanisation on health must be examined in more detail.

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