

DIET THAT PREVENTS CANCER: RECOMMENDATIONS FROM THE AMERICAN INSTITUTE FOR CANCER RESEARCH

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The current epidemiological transition in less developed countries is resulting in an epidemic of chronic diseases, with cancer being the second most common cause of mortality. The evidence linking diet to the development of cancer is based largely on epidemiological analysis of the relationships of the frequency of different cancers to data on food consumption. Cohort results have made clearer the link between diet and cancer, as have data on a number of biological mechanisms. Based on the available data, recommendations on dietary practices that may prevent cancer have been published recently by the American Institute for Cancer Research and the World Cancer Research Fund. Key recommendations are: diet should be based on plant products; 400 g of vegetables and fruits, to provide more than 10% of energy, should be consumed daily; cereals, legumes and tubers should provide at least 50% of energy, and sugars less than 10%; no more than 80 g of meat should be consumed, preferably fish or poultry, and limited amounts that are cured or smoked; fat intake should be limited to no more than 30% of energy, with a predominance of monounsaturated and polyunsaturated forms; total salt consumption should be less than 6 g; perishable foods should be kept frozen or refrigerated and consumed promptly; foods should be cooked at low temperatures, better to be boiled or steamed rather than fried or grilled; alcohol should not exceed 2 drinks a day. In addition to these dietary guidelines, cancer prevention may be achieved by not smoking, by avoiding excess weight, and by increasing physical activity, including half an hour of exercise and 4 hr not resting in a chair or bed. *Int. J. Cancer Supplement* 11:85–89, 1998.

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SITUATION AND RECOMMENDATIONS

Cancer in less developed countries

The epidemiological transition in Mexico and in the majority of Latin American countries is giving rise to a true epidemic of chronic degenerative diseases, among which cancer is in second place as a cause of mortality (Fernández, 1996). However, cancer is not necessarily a toll human beings must pay for longer life expectancy, improved economic standards and high social development. Until now, this has appeared to be the case, since there is a strong correlation between the per-capita income of a country and the importance of cancer as a health-deteriorating agent which, in turn, is related to increased medical expenses and a cause of high mortality rates (World Bank, 1993). Quite possibly, other factors contributing to cancer risk are lifestyle characteristics, such as the use of tobacco and alcohol and the consumption of certain foods, as well as how these are prepared, preserved and cooked.

The less developed countries changed from a diet based on grains, legumes, fruits and vegetables, to one full of fats, animal products and low-quality processed food products, all with high energy density. This is known as the dietetic transition which, taken together with a sedentary lifestyle, especially among younger people (even children and adolescents), constitutes a risk factor for the later development of chronic diseases and cancer. The basic change in dietary habits consists in ceasing to eat natural foods, which normally contain fiber, anti-oxidants and phytochemicals, in favor of consuming processed foods, refined products and additives as the major sources of energy (Chávez *et al.*, 1993).

Cancer has increased rapidly in the majority of less developed countries (which account for about half of humankind), since they

are undergoing rapid changes in dietary habits and in lifestyles (Muñoz de Chávez and Chávez, 1997). It is precisely in these countries that implementation of measures on nutrition and public health could be useful in avoiding "dietetic modernization", at least in its more harmful aspects.

In approximately 100 countries, including large ones such as China, Brazil and Mexico, the emergence of chronic diseases has been so sudden that there has not been enough time to change national health systems. In such countries, non-transmissible chronic diseases now cause more deaths than do infections. This means that most countries already have a combination of both types of problems, sometimes in the same community, family or even person; for example, it is common to find in the same family a child suffering from moderate malnutrition and many infections, while the parents are afflicted with obesity, diabetes and cardiovascular diseases. The irony is that the survivors of malnutrition appear to succumb later in life to these chronic diseases (Muñoz de Chávez, 1998).

Situation in Latin America and the Caribbean

Latin America is changing rapidly and, as a result, child mortality rates have decreased, as have, to a greater extent, the frequencies of some transmissible diseases such as measles, whooping cough and diarrheal disorders. Moreover, the prevalence and severity of malnutrition have decreased in some of these countries, since fewer children today have low body weight. In contrast, half of the Latin-American countries already list cancer as the second or third cause of death. In three quarters of the countries, cancer kills more people than any infectious disease, and in one third cancer is increasing very rapidly (Pan-American Health Organization, 1990).

Cancer mortality and the types of cancers vary from country to country (Table I). The mortality rate from cancer in the countries in more advanced stages of transition is twice the rate in those where transition is moderate, and in the latter it is twice that in countries where transition is only beginning. The sites of the most prevalent cancers also differ among countries, depending on population genetics and prevalent diets (Table II).

Cancer death rates are correlated with many socio-economic factors (Table III), but one of the highest correlations is with diet, mostly with the consumption of animal products (Fig. 1). This figure is highly significant, and is probably independent of economic conditions. With knowledge of the affected countries, it is possible to explain some of the small deviations from the overall correlation. In countries with very low average incomes and cancer mortality, under-diagnosis may be a problem, whereas, in countries with high average incomes and low cancer prevalence, it may be that the revenue from petroleum does not reach the general population. In other countries, such as Cuba, the situation is reversed: there, development of cancer is common and the per capita income is low. Indeed, cancer prevalence correlates also with diets of the "Western" type, as in Argentina and Chile, countries in advanced transition.

Most of the less developed world is on the threshold of a pandemic of non-transmissible chronic diseases which, since they

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TABLE I – CANCER RATES IN LATIN-AMERICAN COUNTRIES¹

	High		Medium		Low
Argentina	144	Jamaica	68	Peru	32
Chile	128	Venezuela	63	Honduras	24
Cuba	127	Mexico	62	Bolivia	22
Costa Rica	91	Columbia	62	Guatemala	20
Panama	82	Brazil	40	Ecuador	13

¹Per 100,000.

appear late in life and evolve slowly, have not caused as much alarm as other pandemics, such as those of infectious diseases. With regard to cancer, the number of cases and the associated suffering should have caught the attention of most countries around the world.

What can be done? Is it possible to prevent cancer?

Possibly between 30 and 50% of the common types of cancer can be avoided solely by changing diet (Willett and Trichopoulos, 1996). This statement is based on a wide range of research results, ranging from animal experiments to epidemiological observations, such as those made on migratory populations, on hundreds of case-control studies and, above all, on longitudinal observations of population cohorts (Multiple Risk Factor Intervention Trial Research Group, 1982).

From all the published reports it is possible to arrive at a number of conclusions and hence to make recommendations regarding food consumption and diets, leading to the idea of food guides for the public. This work has been completed by a panel of 14 international experts convened by the American Institute for Cancer Research and the World Cancer Research Fund (AICR/WCRF), who worked for 3 years and met several times in different parts of the world to analyze the evidence on relationships between diet and cancer and, on the basis of these relationships, to propose concrete preventive measures (World Cancer Research Fund, 1997).

In less developed countries there is an idea that better health may be achieved by reversing the process of transition, by changing some habits of the “modern” lifestyle opting for a return to traditional diets, with more physical activity and weight control. This type of change can be useful in avoiding many of the common types of cancer, but there are numerous different regional habits. Therefore, it is better to consider the basis of the food guides, which should be the same for all human beings, since they are based on biological research underlying the strategies for the prevention of cancer or at least its postponement to a more advanced age (Surgeon General, 1988; Coleman *et al.*, 1993).

Overview of the recommendations

The 14 recommendations published by AICR/WCRF relate to the consumption of food and alcoholic drinks, including methods of conservation and preparation, as well as other dietary considerations to prevent cancer. The importance of these factors varies according to country and culture, but they should be considered from very early in life (from 2 years of age) and with very few exceptions, especially when there are risks of malnutrition, as is frequent in less developed countries. A major problem concerns the size of food portions, which varies with country and culture. Since there was no way of avoiding this variability, portions were defined by the usual “Western” standards (American Cancer Society, 1996).

The first 3 recommendations refer to diet in general, to weight maintenance and to physical activity. They emphasize the importance of basic consumption of dishes made with various plants, give advice for the prevention or treatment of obesity, and highlight the need for physical exercise.

The next 5 recommendations refer to specific food groups and to alcoholic drinks; they advise (1) a diet high in vegetables and fruits; (2) enough cereals and grains, preferably whole-grain products; (3)

low consumption of red meat; (4) certain fats and oils; (5) only a very small quantity of alcoholic beverages.

Another 5 recommendations refer to the way in which food is processed, and the need for proper storage and preservation; the regulation of additives and residues; the limited use of salt; and avoidance of burning or excessive frying of food.

Recommendation 14 discusses the advisability of consuming supplements such as anti-oxidants. Finally, the importance of not using tobacco is emphasized.

Details of dietary recommendations to prevent cancer

The following recommendations are directed to individuals, although they can also be presented in the form of guidelines for population groups:

1. Consume a well-balanced diet rich in fruits, vegetables, legumes and cereals not highly processed. The recommended diet is based on plant foods, plenty of fruit and vegetables, and also, as part of each meal, products with only slightly processed grains. There is evidence that a diet high in plant foods provides protection against several types of cancer (Steinmetz and Potter, 1996). According to various studies, the fact that these foods are low-energy also provides protection. Their effect can be direct or indirect, brought on by excluding some foods with a high concentration of energy, such as animal products, fats and soluble sugars (Pariza and Boutwell, 1987).

2. Avoid excess weight and, above all, weight gain of more than 5 kg during adulthood. The number and quality of publications stating that excess weight can be a risk factor for endometrial cancer are convincing (Austin *et al.*, 1991), and the same can be said with respect to breast and kidney cancer for post-menopausal women. There is also evidence for an association between obesity and colon cancer (Williamson *et al.*, 1995). Much has been published on childhood and adolescent obesity and the risk of contracting cancer at a later age (Le Marchand *et al.*, 1991). Being overweight only at a mature age (BMI = 25 to 30) and weight increase late in life are also risk factors for developing cancer. Some data show that low weight (BMI < 18) can also be a risk factor for cancer (Tuyns *et al.*, 1988).

3. Increase physical activity up to 4 hr a day of non-sedentary life and half an hour of exercise or the equivalent. The amount of energy in relation to the resting metabolic rate that WHO recommends should be expended daily is 176% in young persons and 164% in older men (WHO, 1990). This recommendation is proposed as a general measure to prevent several chronic diseases. Absence of exercise favors the development of colon cancer, possibly even mammary and rectal cancers (Gerhardsson *et al.*, 1988). Lack of exercise also favors excess body fat and therefore, indirectly, those types of cancer related to obesity.

4. Consume 5 or more portions of fruit and vegetables daily. This recommendation is very important, since there are convincing data that these foods protect against respiratory and upper-digestive-tract cancers (Aruna and Sivaramakrishnan, 1990). Amounts around 600 g are suggested during the winter months, especially of green and raw vegetables. There is specific evidence that the *Allium* family (garlic and onions), carrots, tomatoes and citrus fruits help to prevent colon cancer (Albanes and Taylor, 1990). These foods and green leafy vegetables play an important role in preventing pancreatic, mammary and cervical cancer, and possibly help to prevent nasopharyngeal, liver, ovarian, endometrial, prostate, thyroid, kidney and bladder cancer (WHO, 1990). These scientific data, taken together, are the most convincing of all regarding the effect of food on the risk of developing cancer.

5. Consume more than 7 portions daily of grains, roots, tubers and bananas with little industrial processing; limit consumption of soluble sugars. All diets high in fiber and complex starches probably reduce the risk of colon, rectal and mammary cancer (Howe *et al.*, 1992), while sugar intake is associated with rectal

TABLE II – CHARACTERISTICS OF REGIONS AND TYPES OF CANCER PREVALENT IN LATIN AMERICA

Region	Characteristics	Diet	Prevalent cancers
Temperate America, South cone: Argentina, Chile, Uruguay	Mostly European, high development	Wheat, animal products	Lung, breast, large bowel
Indo-America, Highlands: Mexico, Central America, Colombia, Ecuador, Bolivia, Peru	Large native population, medium or low development	Corn, beans, potatoes	Stomach, cervix, breast
Tropical America, Lowlands: Caribbean, Venezuela, Brazil	Large population of African origin, medium development	Starchy roots, rice, sugar	Prostate, cervix, breast, lung

TABLE III – CORRELATIONS BETWEEN CANCER DEATH RATES, DIETARY FACTORS AND SOCIO-ECONOMIC STATUS OF LATIN-AMERICAN COUNTRIES

Variable	Correlation (r)
Cancer death rates/animal food consumption	0.81
Cancer death rates/total fat consumption	0.79
Cancer deaths as percentage of total deaths/animal food consumption	0.74
Animal food consumption/national gross income	0.88
Cancer death rates/national gross income	0.60

cancer (Benito *et al.*, 1990). In addition to the effect of fiber, foods in this group may have positive benefits, since some of them contain anti-oxidants and bio-active phytochemicals (carotenoids in sweet potatoes, folates in legumes, vitamin E in whole-grain cereals, vitamin C in potatoes).

6. Do not consume alcohol, or consume it in only moderate amounts. There is convincing evidence that alcohol causes cancer, especially in the mouth, pharynx, larynx and esophagus. It is also related to liver, colon, rectal and mammary cancer (Doll and Peto, 1981). Since breast cancer occurs mostly in women, it is recommended that women should not take more than one drink per day. For men, a limit of 2 drinks per day is suggested (Friedenreich *et al.*, 1993).

7. Intake of red meat should not be more than 80 g/day, with substitution of fish or chicken. All diets high in beef, pork, lamb or goat meat, and especially processed products made with these meats, increase the risk of colon and rectal cancer and, quite possibly of pancreatic, prostate and kidney cancer (Binham, 1988). In part, at least, this is due to the content of saturated fat, so that consumption of these types of meat may favor the onset of lung, ovarian, endometrial and prostate cancer (Lissner and Heitmann, 1995).

8. Limit total fat consumption, and use moderate amounts of vegetable oil instead of animal fats. Restriction of dietary fat should include fat-containing foods and the use of fat for cooking; the latter is often excessive in some cultures. Vegetable-based oils should be preferred over other fats. Re-heated or re-used oils form trans-fatty acids that can be as harmful as saturated fat (Cannon, 1992). As in the case of cardiovascular diseases, it appears that mono-unsaturated fats, such as olive oil and others, especially with a minimum of hydrogenation, can have a neutral or even beneficial effect in relation to cancer risk (Willett and Trichopoulos, 1996). The overall amount of fat in a diet should not be more than 30% of all sources of energy, but, when a diet low in fat is the cultural norm, then the limit should not go beyond 20% of energy. The types of cancers most suspected to be related to the consumption of fats are those of lung, ovary, endometrium and prostate.

9. Limit consumption of salty foods, and refrain from adding salt to table food. It is recommended to consume not more than 3 g of salt for every 1,000 kcal of food; for young children the amount should be less than 3 g overall, regardless of energy intake. The recommendation for children may be especially important, since there is evidence that early consumption of salt influences the later development of various types of cancer in the upper digestive tract.

It is possible to use spices and herbs to flavor food. In the case of chili peppers, there is no clear evidence of a relationship to gastric cancer (López *et al.*, 1994).

10. Do not consume food that might be contaminated with fungus or yeast (mouldy foods), whether these be tainted or in a spoiled state. This recommendation is especially important in Africa and Asia, where some products are deliberately consumed in a spoiled state, *e.g.*, those fermented for a long period. This custom is associated with high rates of cancers of the upper respiratory or the digestive tract and of the liver (Wang *et al.*, 1992). The same risk exists in cereals and vegetables stored for a long time at high temperatures. The best-known risk factor is aflatoxin, but there are several other fungus or yeast compounds that are potentially carcinogenic (Quian *et al.*, 1994).

11. Use refrigeration or any other effective method for preserving perishable goods. Refrigeration quite possibly offers protection against many types of cancer, since it avoids the proliferation of moulds, bacteria, viruses and the evolution of unwanted compounds, also because it favors higher consumption of fruit and vegetables. There are important differences in the type and frequency of some cancers before and after the introduction and proper use of refrigeration (La Vecchia *et al.*, 1990).

12. Food with several additives and contaminating agents in excessive quantities should be consumed only occasionally. There is epidemiological evidence that, in underdeveloped countries, chemical residues can be a factor in causing several types of cancer (WHO, 1993). There are not sufficient studies on the various additives or mixtures of additives to date but, whenever possible these should be avoided. In developed countries, food additives are under regulatory control, so the issue is seldom relevant.

13. Do not consume burnt or charred food, especially meat and fish. Avoid grilling foods over a direct flame, as well as frying or boiling in excess. Consume cured or smoked meat and meat juice only occasionally. All diets including large amounts of overcooked food are related to an increase in stomach cancer; this is also true of an excess of grilled or charcoal-grilled meat and even fried meat, associated with colon and rectal cancer (Ward *et al.*, 1997). Consumption of cured and smoked meats has been linked with increased risk of gastric cancer (Tajima and Tominaga, 1985).

14. People who follow the above recommendations probably will not need supplements. There is evidence that diets and supplements providing good amounts of anti-oxidants, such as carotenoids, and vitamins A, C and E, protect against various types of cancer (Zhang *et al.*, 1994), while other cohort studies have examined other micronutrients, with positive results (Wattenberg *et al.*, 1985). However, these results should not be taken as an indication that supplements are necessary. In fact, for the time being, evidence is somewhat confusing, since 2 studies of smokers and lung cancer have shown that beta-carotene can have an unfavorable effect (Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group, 1994). More experience is needed before recommendations can be made with respect to supplementation of specific anti-oxidants, vitamins or phytochemicals.

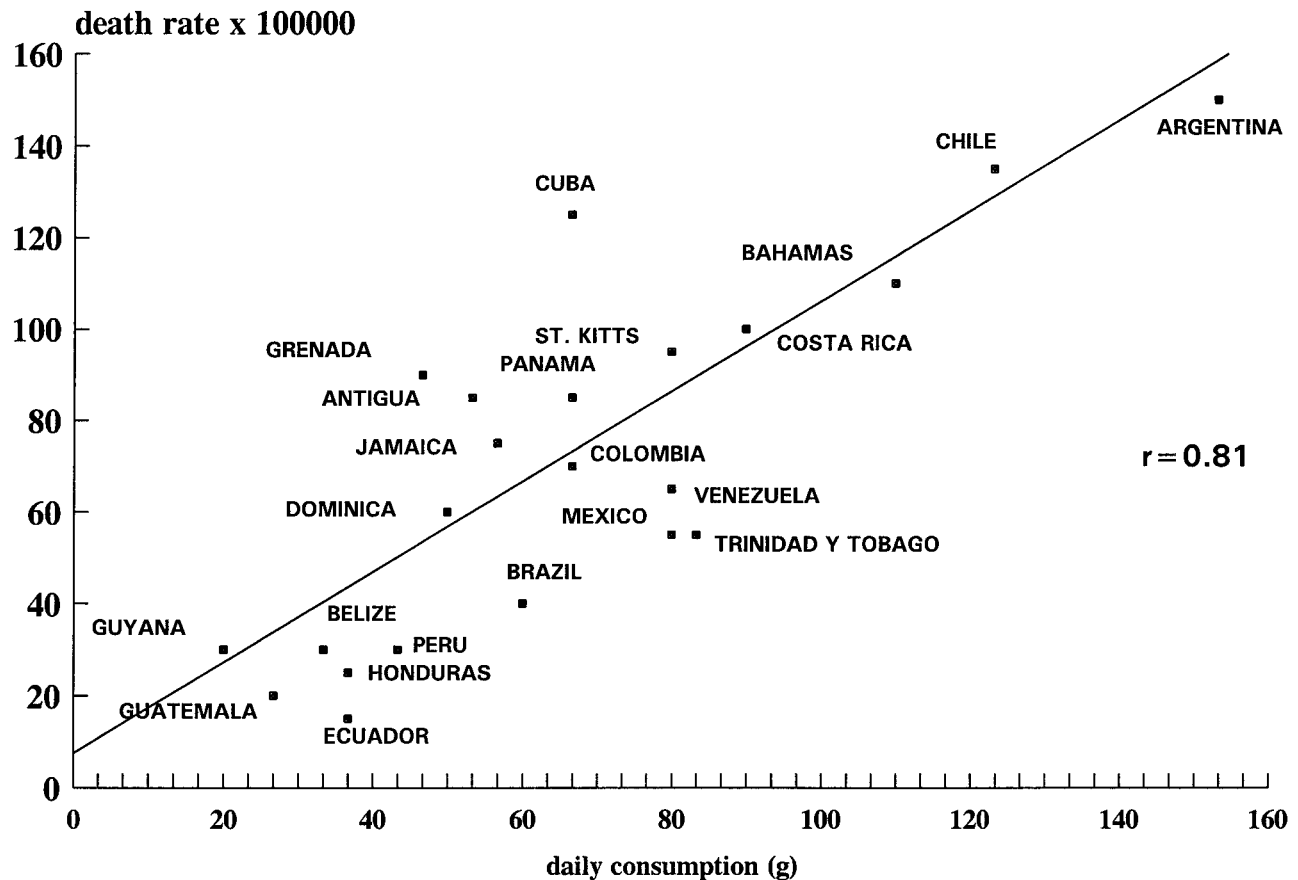


FIGURE 1. – Correlation between cancer death rates and consumption of animal foods in some Latin-American and Caribbean countries.

15. Synergistic effect of tobacco (smoked or chewed) with some dietary factors. There are data showing that the use of tobacco, combined with the consumption of alcohol and foods such as animal products and their fats, can enhance the risk of lung, pancreatic, cervical and bladder cancer (Riboli *et al.*, 1996).

Diet during early life and subsequent cancer

With regard to cancer in children, there are a few studies suggesting that some maternal dietary habits, such as excessive consumption of cured meats, can be a risk factor for certain tumors, especially in the central nervous system. Probably over time, and with better epidemiological methodology, it will be possible to demonstrate similar relationships.

In general, diet during infancy has not been shown to be a risk factor for cancer. Whether there is any association between specific components of childrens' diets in the prevention of cancers in later life also requires further study. As has been stated already, research is being carried out now on the influence of diet in early life on the risk of chronic disease in adulthood, assuming that bad food habits in children can have a cumulative effect that will be manifest later in life. Advice such as that given in the food guidelines of the AICR/WCRF should be implemented as early as 2 years of age.

Families with children who have cancer should be considered as at high risk, especially since many types of cancer, particularly the ones that appear in children, may be attributed to genetic alteration or exposure to radiation or viruses, and consequently these risk factors may be shared by other members of the family. The worst thing that can happen in these families is a combination of risks, for example, genetic alteration compounded with bad dietary habits, which together could lead to cancers or other chronic diseases. This means that a change in the food habits of children can be particularly important.

Possibilities for preventing cancer in developing countries

A key point is determining whether it is possible to conduct programs that will stop the growing cancer epidemic in less developed countries, of which few have the necessary resources for public health and nutrition programs, while extensive funds are needed to control infectious diseases. At the same time, some governments are fearful about the possible effects on their economies, and on certain large industrial companies, if changes in the general lifestyle are proposed, e.g., reducing the use of tobacco and alcohol, and limiting consumption of some animal foods, or products such as soft drinks and foods high in fat, sugar and salt. Education of health professionals may be the most important limiting factor in poor countries, where most physicians do not know whether cancer can be prevented and are not aware that a great deal could be achieved by taking certain measures, such as those on diet, which do not necessarily require large amounts of money.

Neither government authorities nor medical practitioners are fully informed about the role of foods and diet in the causality or the prevention of cancer. Thus, dissemination of the concepts presented here could very well be an important first step. It is of paramount importance for every country to establish a committee on cancer and nutrition, formed by specialists, in order to study the dietary guidelines and select those that could be implemented according to local resources and priorities. The measures taken should be easy to promote, in particular the consumption of relevant foods of local or regional cultures. In many developing countries, cereals, roots, vegetables and fruits are readily available. Many are or were accepted by local cultures, but sometimes abandoned because of the dietary transition. In such cases, people should resume eating these foods, perhaps including some of the ready-to-eat commercial preparations; for example, the use of corn

meal to prepare corn tortillas or ready-to-eat products already on the market in Mexico.

When applying the food guidelines to prevent cancer, it is advisable to insist on measures similar to those proposed for preventing other chronic diseases. This can be a major advantage in less developed countries, since highlighting those with more general effects gives a better cost-benefit ratio.

Several kinds of programs could be implemented without great cost. They include educational campaigns in schools, advertising in the mass media, promoting consumption of seasonal vegetable products and, most of all, urging industrial, agricultural, trade and legislative bodies, also the medical and other professions, to

promote healthier lifestyles and diet, as well as exercise and weight control.

It is essential to involve the less developed societies as a whole, since they are menaced by the cancer pandemic, which in one or two generations may involve millions of their people. It can be prevented only by acting now, during the lifetime of this generation, starting among school children and teenagers, among women before they are married, among future parents, and among adults at risk. The guidelines proposed by the International Panel of Experts of AICR/WCRF must be promoted by a coalition of community leaders and physicians' associations, acting together to launch major campaigns for the dietary prevention of cancer.

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