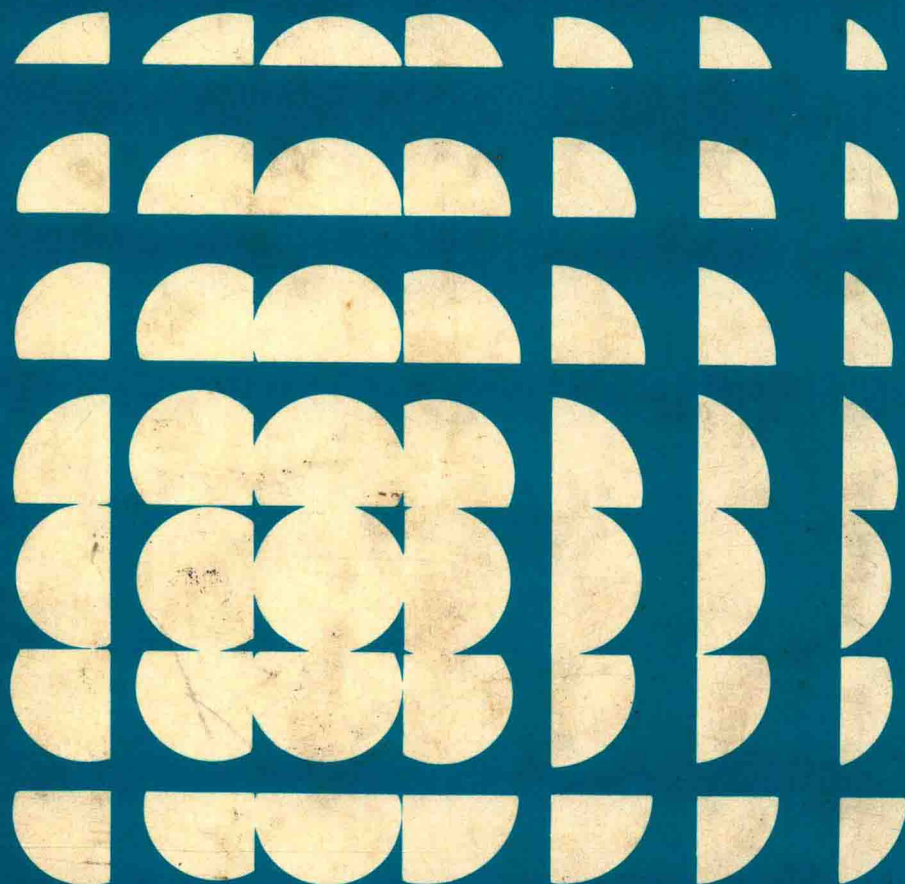


**Progress in
Cancer Research and Therapy
Volume 17**

**Nutrition and Cancer
Etiology and Treatment**

Editors

Guy R. Newell - Neil M. Ellison



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Cancer Research and Therapy
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Nutrition and Cancer:
Etiology and Treatment

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*Progress in
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**NUTRITION AND CANCER:
ETIOLOGY AND TREATMENT**

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Preface

Evidence from *in vitro* animal, and human studies shows that diet and nutrition play a role in the etiology and treatment of cancer. "Diet" means all substances ingested during the course of eating; "nutrition" refers to those essential dietary elements that the body is unable to synthesize *de novo*.

Although man is constantly exposed to varying amounts of cancer-causing agents, only a few are probably carcinogenic at the very low levels found in the diet. Most require activation and become carcinogenic through cocarcinogenesis or by tumor promoters. Carcinogens may be found as inherent components of food—naturally, through methods of food preparation, or as contaminants of foods. Carcinogens may also be produced endogenously from ingested food-stuffs. Thus, the relationship between nutrition and cancer ranges from the induction of cancer—to cancer prevention—to cancer treatment. Nutritional assessment plays an important part in determining the etiology and treatment of cancer.

This volume combines the current knowledge of etiology, assessment, and treatment of cancer and nutrition. It will serve as a valuable reference for understanding the relationship between nutrition and cancer.

Epidemiologists and nutritionists interested in the cancer problem, as well as oncologists or other practitioners concerned with the relationship between cancer and nutrition, will find this volume useful.

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Introduction

During recent years there has been a growing awareness by the oncologic community about the important association between nutrition and cancer—as a means of prevention and treatment. In the past, preventive efforts were virtually neglected or overlooked. The major focus in supportive care was directed toward systems of blood product replacement and treatment of infectious complications. We now recognize that this was not enough.

It is currently estimated that malnutrition in hospitalized patients may range from 20% to 50% and if divided into disease categories, cancer patients often make up the significant portion of these malnourished patients. Increasing evidence demonstrates that good nutrition, or lack of it, affects cancer patients just as it affects other patients with acute or chronic illnesses. Yet, while it is realized that good nutrition may enhance a beneficial cancer treatment, it cannot make a poor therapy effective.

In the area of prevention, epidemiologic correlations demonstrate definite patterns of neoplastic occurrence associated with nutrition as addressed in the first two chapters. For example, it hardly seems surprising that studies show diets high in total fat and low in certain fibers are associated with an increased incidence of large bowel cancer. For many of the more common cancers in this country (oral, esophagus, colon, breast, prostate, and stomach cancer), each individual does exert a certain amount of control over his own cancer risk through diet and lifestyle. As more is learned about the mechanisms of mutagens and carcinogens, and as inroads are made in the newly developing field of chemoprevention, it may be routinely possible to inhibit, block, or reverse the cellular processes involved in carcinogenesis by dietary modifications. Studies examining possible cancer associations for fat, fiber, vitamins, minerals, trace elements, alcohol, food additives, and contaminants as well as the timely topic of artificial sweeteners are all included in the first half of this volume.

Because diet as an environmental variable must be measured to accurately quantify its impact on the development of human cancer, an entire section covers the approaches to nutritional assessment. Despite the multitude of biochemical, immunologic, anthropometric, and body compositional parameters used for nutritional assessment, a single test has not yet emerged as the sole accurate indicator of nutritional status. Likewise, there is no generally accepted method of measuring the dietary intake of individuals. Considering the critical importance of accurate nutritional assessment, all of these topics are dealt with in detail.

In the treatment and care of cancer patients, malnutrition plays a dual role.

First, malnutrition can create a detrimental effect on multiple aspects of the treatment process. Malnutrition may adversely affect a patient before he or she receives medical care, interfere with the delivery of optimal oncologic therapy, prolong the morbidity of therapeutic complications, and have a detrimental effect on the patient's quality of life.

Second, optimal nutritional care can, in many instances, reverse these negative influences. Nutrition is now considered a positive therapeutic tool to complement advances in more traditional therapies such as chemotherapy, radiotherapy, surgery, and immunotherapy for cancer patients. Nutritional problems associated with cancer chemotherapy and radiation therapy are addressed in separate chapters as is the topic of nutrition for the pediatric cancer patient. Because many of the factors of diet and dietary contaminants in the etiology of adult cancer pertain in a very special way only to the pediatric age group, it is essential that the topic receives a chapter of its own dealing primarily with the effects of nutrition on the course of childhood cancer.

Finally, a discussion addressing the important contribution of enteral chemically defined diets and intravenous hyperalimentation, completes the section on nutrition as a positive therapeutic tool. Since its introduction in the early 1960s, this intravenous technique for nutritional replenishment has drawn international attention. Only during the last 5 years has the significance of nutritional rehabilitation and maintenance of the cancer patient before, during, and after treatment been scientifically addressed. Nutritional replenishment is now possible to some degree in almost all cancer patients, and the roles that adequate building blocks such as carbohydrates, amino acids, vitamins, minerals, and fats play in the management of acute and chronic illnesses are being increasingly recognized and appreciated.

It is only appropriate that all of the topics mentioned here be handled under one cover. The biological relationships between nutrition and cancer are multifaceted and intricate. Included among these relationships are identifications of dietary risk factors, improving patient care, and possibly enhancing treatment effectiveness. Perhaps this new appreciation of the impact of nutrition on cancer will lead to not only improved patient care and treatment but, more importantly, also to preventive efforts that affect the disease at the causal or development stage and lead to tremendous savings in both economic terms and in human lives.

W. Bryant Boutwell
Guy R. Newell
Neil M. Ellison

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Nutrition and Cancer: Epidemiologic Correlations

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In the search for factors related to cancer etiology investigators have frequently taken advantage of data on the availability of foods among different populations. International data based on the "disappearance" of food items from the marketplace are collected and published by the Food and Agriculture Organization (FAO) (11). Within a given country, these data are usually collected by the Department of Agriculture or by special surveys (36). Occasionally, enough internal variation exists to justify their use in studies dealing with cancer etiology. National figures on food intake can be correlated with cancer frequency based on mortality data collected by the World Health Organization (31), or with incidence figures published by the International Association of Cancer Registries and the International Agency for Research on Cancer (38). Both sets of data are available for a limited number of countries.

This chapter will include a brief review of the published work on international correlations, an update on some of the results, and a discussion of their possible usefulness in the search for etiologic factors and preventive measures.

BRIEF REVIEW OF CORRELATION STUDIES

The notion that nutrition and cancer might be interrelated is an old one. In modern times, one of its most articulate advocates has been Tannenbaum (34). His many contributions were mainly in the experimental field, but he also performed some correlation studies, mostly based on the statistics of life insurance companies, in which he found a positive association between overweight and several types of cancer. He simulated this human situation in numerous animal experiments and firmly established the fact that excessive nutrition enhances cancer development and progression (35).

Intercountry data on dietary intake were utilized on a large scale for correlation studies with coronary heart disease before similar studies were performed for neoplastic disease. An initial positive correlation between coronary heart disease and total fat intake was later found to be even stronger when saturated fats alone were considered (21). Many studies primarily concerned with cancer have

also included coronary heart disease in their analyses because of its well-known correlation with certain neoplasms (39).

Cancer correlation studies were greatly facilitated by the pioneer work of Segi, who collected data and adjusted cancer death rates to the now widely used "world" population model (31). Lea, in 1967, correlated cancer death rates, as adjusted for age by Segi, with the availability of foods, as provided by the FAO publications (23). He was impressed by the fact that neoplasms seemed to fall into two groups: Group 1 was positively correlated with the ingestion of fat, sugar, animal protein, eggs, and milk; prominent neoplasms in this group were cancers of the breast, ovary, large bowel, and prostate. Group 2 consisted principally of cancers of the stomach and liver, and showed a negative association with such food items.

Wynder and co-workers (39,40), in reporting on studies of analytical epidemiology of colon cancer, concluded that dietary factors, and especially the high intake of fat, appeared to be associated with the etiology of colon cancer. A positive correlation between death rates from colon cancer and myocardial infarction was reported, again pointing toward possibly related dietary etiologies for both diseases.

Death rates for gastrointestinal cancer were correlated by Gregor and co-workers with food intake, in an effort to explain the negative correlation between death rates from gastric cancer and colon cancer (14). They reported that animal protein intake correlated positively with the death rate from colon cancer and negatively with gastric cancer. They corroborated previous findings by Dunn and Buell, who reached similar conclusions about the role of diet in gastrointestinal cancer while studying time trends in Japanese immigrants to California (7). A positive correlation between breast cancer death rates and the intake of fat and calories was reported by Carroll and co-workers (4), who were of the opinion that fat intake was the most relevant parameter.

The relationship of dietary intake to breast cancer during the premenopausal and postmenopausal periods has been reported by Hems (16). He concluded that the intake of sugar and fat accounted for three-quarters of the intercountry variation in postmenopausal breast cancer, whereas in premenopausal breast cancer genetic factors appeared to have a stronger influence.

Updated studies of incidence and mortality by Draser and Irving found no correlation of dietary items with gastric cancer, but found a positive correlation between breast and colon cancer rates and total intake of fat, animal protein, eggs, and sugar (6). Correlations with other indicators of affluence, such as income and number of automobiles and television sets, were also positive. No correlation with fiber intake was found.

The correlation between colorectal cancer and diet was analyzed by Howell (18,19), using international dietary data, data of a case-control study conducted by Haenszel et al. (15), and data on food consumption within the United States. Her correlation studies were based on incidence and mortality rates, and again showed a positive association of colorectal cancer frequency with fat and animal