

Nutrition and Cancer Research: Resources for the Nutrition and Dietetics Practitioner



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THIS ISSUE FOCUSES ON ISSUES IN THE INTERSECTION of nutrition science and cancer prevention research. In this commentary, we provide a high-level orientation for readers to nutrition and cancer. We begin by reviewing the burden of cancer, which has necessitated public policy recommending improvements to diet for the prevention of cancer in the United States, although this is true of many other countries as well. These policy recommendations are based on a critical review of scientific evidence linking diet and cancer. We then discuss the inconsistencies in the nutrition–cancer scientific literature and the subsequent issues registered dietitian nutritionists (RDNs) face when translating this literature in clinic settings. We conclude with some resources for practitioners and general guidance.

CANCER BURDEN AND CANCER PREVENTION AT THE POPULATION LEVEL

The United States has a high burden of cancer and US public health policy uses nutrition recommendations as a tool to help combat this burden.¹ The American Cancer Society projects more than 1.68 million new cancer cases will be diagnosed in the United States during 2017.² A 2014 American Association for Cancer Research Report to Congress³ estimated more than half of all cancers are due to preventable causes; in particular, modifiable exogenous and environmental cancer risk factors such as tobacco use, diet, and obesity.^{4,5}

For decades, US public health messages have advocated changes in specific health behaviors to minimize disease risk.⁶ Specifically, the most recent 2015–2020 Dietary Guidelines for Americans (DGA),⁶ jointly issued by the Departments of Health and Human Services and Agriculture,

have served as a national target for public health policy to prevent cancer and other diseases. The DGA recommend that Americans select an eating pattern reflecting not just individual dietary preferences, but also consider personal dietary requirements to promote health, prevent chronic disease, and achieve and maintain a healthy body weight.⁶ Some examples of evidence-based, cancer-relevant public health messages in the DGA include the advice to avoid or limit exposure to known environmental carcinogens (eg, tobacco and aflatoxins) and adopt health-promoting behaviors and lifestyles (eg, increase physical activity, consume a healthy diet, and prevent obesity) to reduce risks for developing cancer.^{7–9} These recommendations result from careful review of the scientific literature. Yet they face many unique challenges as a result of null and conflicting research findings, as we will discuss below. These challenges limit the evidence base and thus the quality of dietary recommendations for the prevention of cancer.^{10–13}

MILESTONES IN THE REVIEW OF THE NUTRITION AND CANCER SCIENTIFIC LITERATURE

In 1997, the World Cancer Research Fund (WCRF)/American Institute for Cancer Research (AICR) conducted the first global systematic literature review evaluating decades of epidemiologic and basic nutrition science evidence, culminating in the first expert authoritative diet and exercise recommendations for preventing cancer.¹⁴ In 2007, a second, more mechanistic-focused WCRF/AICR expert report rated the scientific evidence supporting the association between a dietary component and a cancer site as “convincing,” “probable,” “limited-suggestive,” and “substantial effect on risk unlikely.”¹⁰ This 2007 WCRF/AICR report¹⁰ evaluated all epidemiologic and nutrition science evidence globally, recommending policy and public health actions aimed at reducing cancer risk and occurrence worldwide as well as elucidating knowledge gaps in the diet and cancer scientific literature.

Today, the WCRF/AICR Continuous Update Project (CUP) provides valuable, periodic updates for numerous site-specific cancers for use by researchers, clinicians, and policymakers.¹¹ The CUP project is the most respected source for expert, vetted information on diet and cancer, identifying current research gaps for future prevention research efforts. The preponderance of published nutrition science discoveries suggests whole foods and individual dietary constituents are associated with cancer incidence and mortality.^{15–22} Yet, the CUP project has produced few diet–cancer relationships that are supported by a “convincing” level evidence due to a lack of large human trials, a reliance on small studies and general inconsistencies in the nutrition sciences literature.¹¹

DIET—CANCER PREVENTION LITERATURE INCONSISTENCIES

Despite the best efforts of nutrition science researchers, inconsistencies exist across the diet—cancer prevention scientific literature. Differences in study design (eg, poor statistical power from a small sample or small effect size, variable exposure level and duration, and imprecise measurement of diet), dietary interventions tested (eg, whole foods, single dietary components, and dietary supplements), baseline eating patterns (eg, Western or prudent), and populations sampled (eg, age, health status, and individual genetics) account for many of the inconsistencies observed across diet and cancer prevention studies.^{23–25} However, a researcher cannot possibly avoid all of these pitfalls while staying within their project budget. For example, mechanistic studies often inherently limit the researcher to using only a single food component at a single dose to elucidate a complex mechanism. This more reductionist approach can lead to study irreproducibility because of the complex nature of evaluating human dietary exposures when a hypothesis is moved from a basic study in cells or an animal to a human being.^{13,26}

Practitioners of nutrition and dietetics and other fields must sort through the nutrition science literature and hierarchically prioritize research findings by levels of evidence.²⁷ Diverse lines of preclinical evidence (eg, cell culture and genetic animal models) provide important investigational links often describing scientific phenomenon, testing hypotheses, elucidating potential mechanisms of action influencing carcinogenic events, and evaluating dose efficacies. Adequate research, hypothesis testing, and validation are critical to generating robust preclinical research before proceeding toward larger, more costly studies. Epidemiological evidence from large observational cohorts, although associational in nature, can hypothesize cancer risk, making important research contributions and providing early human evidence. The National Institutes of Health reinforces stringent testing of mechanistic-based hypotheses when evaluating observational data to ensure study rigor and reproducibility.^{28,29} Clinical trials are the gold standard of research, but are often not feasible, cost-prohibitive, or not possible for some nutrition and cancer hypotheses. Study replication and validation efforts serve as important steps as well as preventive strategies against replication failures often attributed to confounding variables, including inter-individual responses to dietary interventions.^{11,30} Still, null effects and unintended consequences occur even in large human clinical trials.^{31,32}

Although small, Phase 0 clinical trials may provide initial evidence suggesting potential dietary efficacy in preventing cancer, larger studies that meet necessary federal research standards for scientific rigor and reproducibility are needed.^{28,29} However, even in the absence of additional adequately powered trials, knowledge can be gained and scientific consensus built from expert opinion to inform clinical guidelines (eg, essential fatty acids and heart disease).³³ In summary, all models have strengths and weakness imposed by physiologic or mechanistic differences limiting their predictive power and clinical utility and should be evaluated based on their strengths and weaknesses when estimating relationships between diet and cancer risk.^{30,34}

Nutrition and Dietetics Practitioner Roles and Resources

The 2012 Academy of Nutrition and Dietetics (Academy) revised professional performance nutrition care standard 3, nutrition intervention, states “The registered dietitian (RD) identifies and implements appropriate, purposefully planned interventions designed with the intent of changing a nutrition-related behavior, risk factor, environmental condition, or aspect of health status for an individual, target group, or community at large.”³⁵ The body of scientific data should be compelling before translating scientific findings to our at-risk, presumed healthy clients for disease prevention and patients with a good prognosis undergoing treatment. Nutrition recommendations should be client-tailored and consider individual health history. For cancer patients, individual cancer type, stage, and prognosis should also be discussed with the care team. This charge requires RDNs and nutrition and dietetic technicians, registered, provide clear nutrition recommendations that accurately describe the level of evidence supporting the recommendations. Below we provide a list of resources for nutrition and dietetics practitioners that the Academy and physician oncologists have recognized as reputable.

Associations between Nutrition and Prevention of Primary Cancers

As mentioned above, the WCRF/AICR CUP project continues to be the premiere expert summary on the direction, magnitude, and strength of evidence supporting relationships between nutrition and specific cancers. Carcinogenic initiation and promotion events produce profound differences within tissues and across organ sites exerting metabolic pathway perturbations.³⁶ Increasing individual adherence to WCRF/AICR recommendations is significantly associated with reductions in several cancer types, including breast, endometrial, esophageal, kidney, liver, lung, and upper aerodigestive tract cancers.³⁷ No association was found for preventing bladder, ovarian, pancreatic, or prostate cancers.³⁷ The American Cancer Society also provides nutrition and physical activity guidelines for cancer prevention. Individuals whose behaviors are consistent with recommendations to maintain a healthy body weight, to be physically active, consume a mostly plant-based dietary pattern, and limit alcohol consumption are at lower risk of developing and dying from cancer.^{38–40}

Associations between Nutrition and Cancer Survivorship

National Comprehensive Cancer Network Guidelines for cancer survivors stress that the best formula for reducing cancer recurrence is a healthy lifestyle founded upon healthy dietary habits, weight management, and exercise to reduce the risk of cancer recurrence and death.⁴¹ Because they are nutrition experts, RDNs are ideally positioned to promote and implement healthy lifestyle interventions for those most at high-risk for developing cancer as well in cancer patients and survivors. Early adoption of healthy dietary behaviors may reduce the physiologic influence of past low-quality dietary patterns, improve quality of life, and reduce future cancer risks.⁴² The American Cancer Society also provides nutrition

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