

HOW DOES NUTRITION IMPROVE RADIOTHERAPY OUTCOMES?

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Objectives

- Discuss the role of nutrition during radiation treatment and how malnutrition alters the ability to tolerate radiation therapy
- Be able to discuss GI specific side-effects of radiation therapy and the nutrition management of these side-effects
- In what patient populations are prophylactic feeding tubes beneficial when undergoing radiation therapy
- Delineate the role of plant based/inflammatory diets in managing treatment side effects
- List benefits of arginine and glutamine in managing radiation therapy side-effects
- Explain risk-benefits for use of antioxidants in radiation therapy

Disclosure

- We have no conflicts of interest to report.

Why is nutrition important?

- Prevents muscle wasting and weight loss
- Improves management of side effects
- Less trips to EC for hydration
- Avoid missing treatments
- Improved quality of life and performance status
- Less fatigue
- Shortened recovery time post treatment
- Decreases infections, morbidity, and mortality

“Let food be thy medicine and medicine be thy food.”

-Hippocrates

Cancer-Related Metabolic Changes

- Alteration of enzyme activity and immune system
- Changes in energy expenditure and basal metabolism
- Changes in carbohydrate, lipid, protein metabolism
- Depletion of fat, protein, water, and mineral stores
- Cachexia

Nutrition Assessment

- Diet history
- Energy and protein intake
- Changes in food and fluid/beverage intake
- Adequacy and appropriateness of nutrient intake or nutrient administration
- Intake from enteral nutrition
- Changes in type, texture, or temperature of food and liquids
- Use of fortified nutrition beverages
- Food avoidance and intolerances
- Meal or snack pattern changes
- Factors affecting access to food
- Medical history
- Labs
- Medications
- Anthropometrics
- Nutrition Impact Symptoms (NIS)
- Functional capacity
- Nutrition focused physical exam

Nutrition Impact Symptoms

- Anorexia and early satiety
- Constipation
- Diarrhea
- Gas
- Nausea and vomiting
- Mucositis and esophagitis
- Dysphagia
- Dysgeusia and ageusia
- Xerostomia and excessive thick secretions
- Weight loss
- Malabsorption
- Fatigue

Managing Side Effects

- **Mucositis/Esophagitis**
 - Choose soft, moist foods
 - Avoid rough textures, acidic, tart, spicy foods
 - Cut foods into small bites and chew well
 - Puree foods in a blender adding milk or broth
 - Add non-acidic sauces and gravies to foods
 - Avoid temperature extremes
 - Drink adequate amounts of fluids
 - Practice good oral hygiene
 - Speak with medical team regarding medications

Managing Side Effects

- **Changes in Taste and Smell**
 - Good mouth care
 - Metallic taste- use plastic utensils, avoid canned foods
 - Salty/Bitter taste- combat with sweet flavors
 - Sweet taste- increase salty and tart flavors
 - Add seasonings such as basil, oregano, mint, rosemary, tarragon, onion, garlic, BBQ sauce, chili powder, ketchup, mustard
 - Marinate and cook meats in sweet juices, fruits, acidic dressings or wines
 - If unable to eat meat, include other protein foods
 - Clear taste buds with sugar-free gum, peppermints, pickles, lemon drops, lemon/lime sorbet, frozen fresh fruits (melon, grapes, oranges)
 - Zinc
 - “Tincture of time”

Managing Side Effects

- **Nausea/Vomiting:**

- Nausea medication 30 minutes before meals
- Small frequent meals/snacks to keep something on your stomach
- Avoid favorite foods
- Avoid greasy or spicy foods; foods with strong smells; cold/bland foods may be best
- Suck on lemon drops, mints, ginger candy, tart foods
- Fluids between meals; use cup with lid and straw if smells trigger nausea
- Clear liquids: soup, broth, gelatin, lemonade, popsicles, tea, ginger ale

Managing Side Effects

- **Diarrhea**

- Increase fluid intake
- Electrolytes lost with diarrhea; increase consumption of high potassium and sodium foods/fluids
- Small frequent meals
- Limit high fiber foods
- Limit high fat foods
- Avoid alcohol, caffeine, spicy foods, hot liquids
- Avoid hot fluids
- Limit or avoid dairy foods if these make diarrhea worse
- Limit sugar-free foods/fluids that contain sugar-alcohols
- Take antidiarrheal medications as prescribed

Managing Side Effects

- **Constipation**

- Gradually add fiber
- Increase fluid intake
- Prune juice followed by large glass warm water
- Hot beverages
- Regular moderate exercise (as tolerated)
- Consider stool softeners and laxatives
- Probiotics

Malnutrition

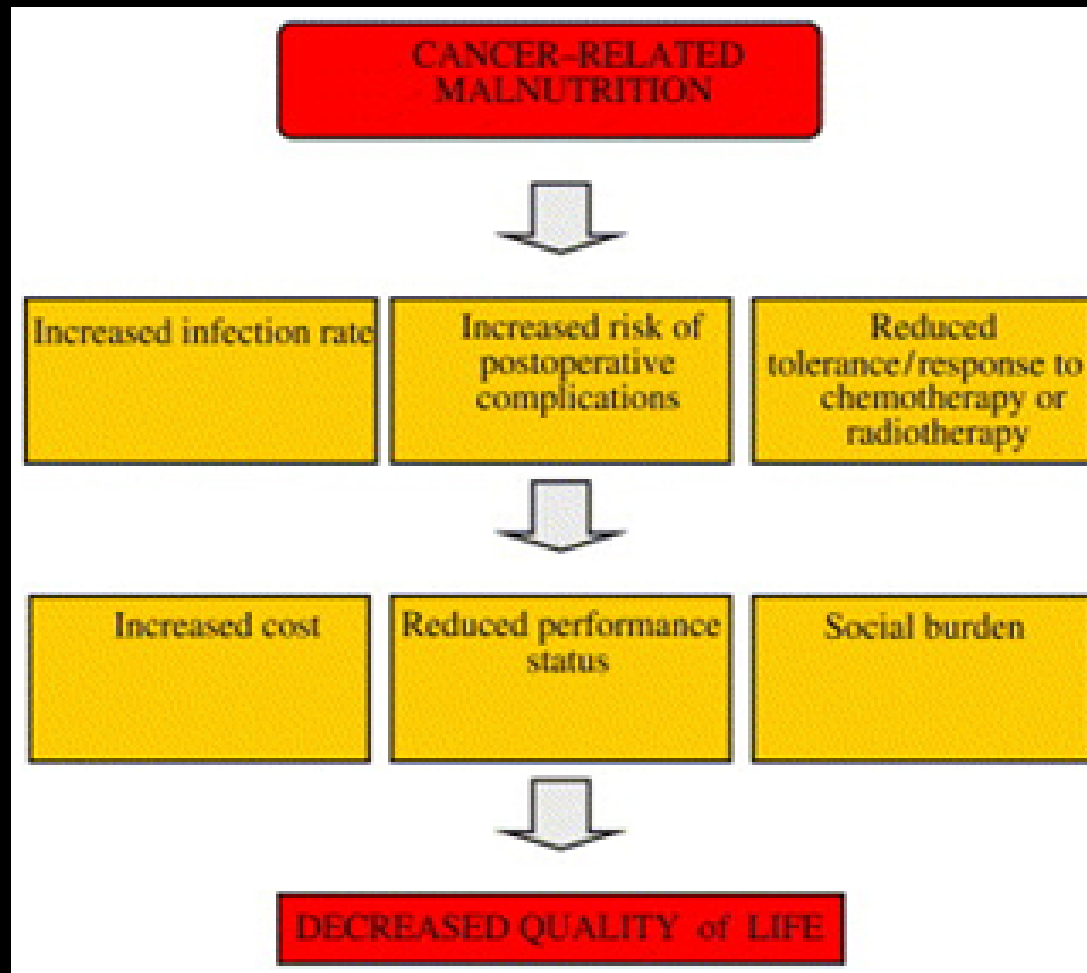
- The Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition (ASPEN) recommends classification of adult malnutrition by etiology:
 - Starvation-related malnutrition
 - Chronic disease-related malnutrition
 - Acute disease or injury-related malnutrition
- Additionally, they recommend that two or more of the following six characteristics would be needed for diagnosis of malnutrition:
 - Insufficient energy (caloric) intake
 - Weight loss
 - Loss of muscle mass*
 - Loss of subcutaneous fat*
 - Localized or generalized fluid accumulation that may mask weight loss*
 - Diminished functional status as measured by hand grip strength

*NFPA used to assess

Malnutrition

- Contributes to increased morbidity and mortality
- Decreased function and quality of life
- Increased frequency and length of hospital stay
- Higher healthcare costs
- Poor wound healing

Figure 1



Nutrition Focused Physical Assessment

- Head to Toe Assessment
- Subcutaneous Fat Loss
 - Orbital region
 - Upper arm region
 - Thoracic and Lumbar region

Nutrition Focused Physical Assessment

- Subcutaneous Muscle Loss
 - Temple region
 - Clavicle bone region
 - Clavicle and Acromion bone region
 - Scapular bone region
 - Dorsal hand
 - Patellar region
 - Anterior thigh region
 - Posterior calf region

Feeding Tubes

- Multiple types – PFG, PEG, NGT/DHT, J-tube, G-J tube
- May be placed prophylactically or reactively
- Pros
 - Patients able to meet nutrition and hydration goals
 - Administer medications
 - Decreases weight loss
 - Fewer treatment interruptions
 - Improved QOL
- Cons
 - Infection/Bacterial contamination
 - Aspiration
 - Dependence

Prophylactic Feeding Tubes

NCCN Guidelines Version 1.2016

- Severe weight loss prior to treatment (5% in 1 month, 10% in 6 months)
- Ongoing dehydration or dysphagia, anorexia, or pain interfering with the ability to eat/drink adequately
- Significant comorbidities that may be aggravated by poor tolerance of dehydration, lack of caloric intake, or difficulty swallowing necessary medications
- Severe aspiration, or mild aspiration in elderly patients who have compromised cardiopulmonary function
- Patients for whom long-term swallowing dysfunction is likely, including those anticipated to receive large fields of high-dose radiation to the mucosa and adjacent connective tissues

AICR Nutrition Recommendations

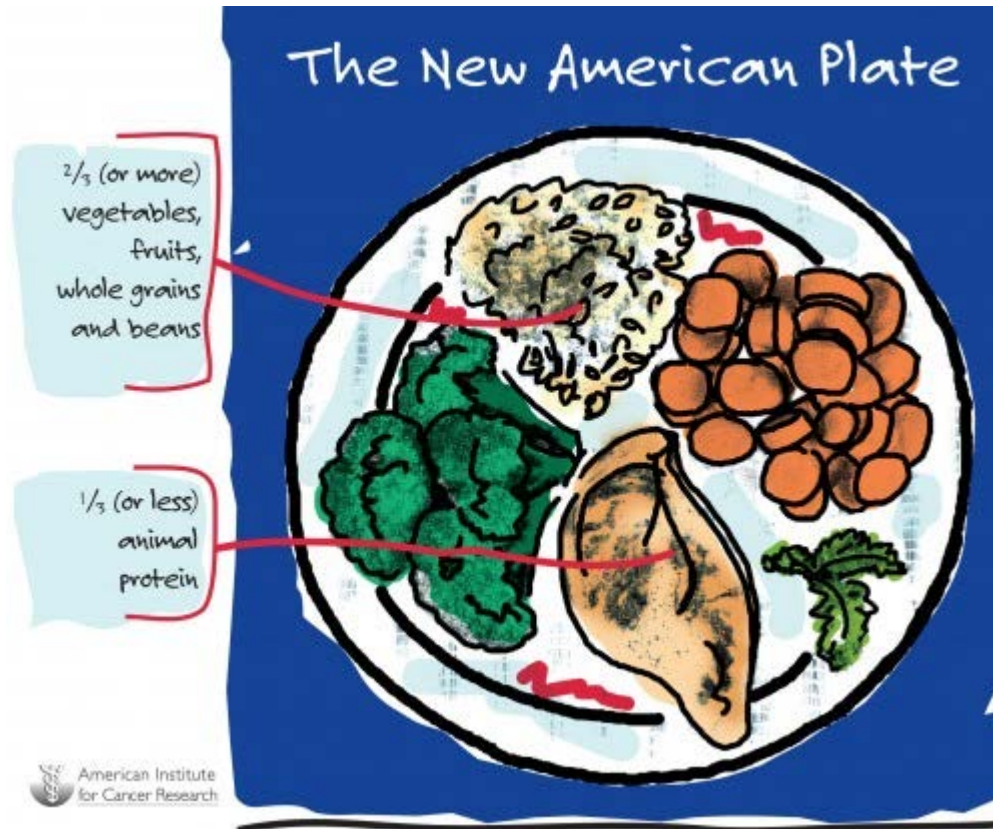


RECOMMENDATIONS
<p>BODY FATNESS Be as lean as possible within the normal range of body weight</p>
<p>PHYSICAL ACTIVITY Be physically active as part of everyday life</p>
<p>FOODS AND DRINKS THAT PROMOTE WEIGHT GAIN Limit consumption of energy-dense foods Avoid sugary drinks</p>
<p>PLANT FOODS Eat mostly foods of plant origin</p>
<p>ANIMAL FOODS Limit intake of red meat and avoid processed meat</p>
<p>ALCOHOLIC DRINKS Limit alcoholic drinks</p>
<p>PRESERVATION, PROCESSING, PREPARATION Limit consumption of salt Avoid mouldy cereals (grains) or pulses (legumes)</p>
<p>DIETARY SUPPLEMENTS Aim to meet nutritional needs through diet alone</p>
<p>BREASTFEEDING Mothers to breastfeed; children to be breastfed</p>
<p>CANCER SURVIVORS Follow the recommendations for cancer prevention</p>

AICR Dietary/Lifestyle Goals

- Plant Based Diet
 - 2/3 Plant Foods
 - Choose colorful produce
 - 1/3 Animal Protein
 - Incorporate meatless meals several times a week
 - Avoid eating processed meats such as cold cuts, bacon, sausage, and ham
 - WHO statement on processed meats
- Physical Activity/Exercise – work to have 30 minutes of moderate activity daily
- Alcohol – despite evidence of a heart protective effect with moderate alcohol consumption, there is not a similar effect with cancer. AICR recommends avoiding even small amounts of alcohol

AICR New American Plate



Nutrition & Cancer: Healthy Diet

The “New American Plate”:

- American Institute for Cancer Research



*Include a few meatless meals weekly.

2/3 of plate = vegetables, whole grain, beans, fruit
1/3 or less of plate = animal protein*



How to Make a Plate Change

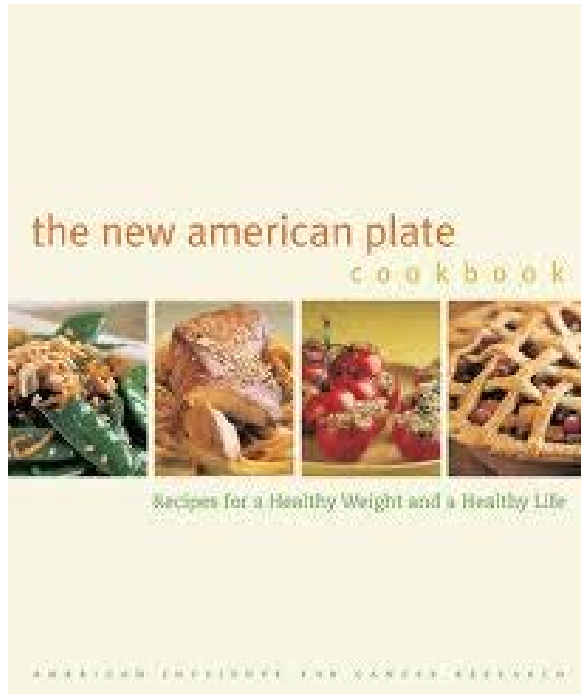
Gradually transition from the old American plate...



to a better plate...



to the New American Plate



Diet and Inflammation

- Dietary foods and its components can be pro-inflammatory, neutral, or pro-inflammatory
 - Anti-inflammatory: foods versus components
 - Foods: Fruits, Vegetables, Whole Grains, some fish
 - Components: Vitamins, Trace elements, Fiber, Phytochemicals
 - Pro-inflammatory:
 - Foods: Dairy and Meats
 - Components: Cholesterol, Saturated Fats, Animal Proteins
- Dietary Inflammatory Index – tool to evaluation whether a particular food, component and/or meal pattern is pro-inflammatory, anti-inflammatory, or neutral
 - Primarily a research tool, utilizes 45 foods/components
 - Based on evaluation of Food Frequency Questionnaire data from large cohort studies

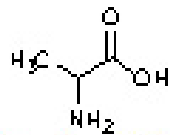
Amino Acid Supplements to Alter Radiation Effects

- Utilize conditionally essential amino acids
- Arginine (Arg)
 - Can be both a tumor promotor and tumor suppressor
 - Why? – Multiple pathways for conversion into other metabolites
 - Nitric Oxide Synthase, Arginase
 - Altered metabolism in cancer cell
- Glutamine
 - Not the primary energy source of cells – exception: large intestine
 - Altered metabolism in cancer cell, part of proliferation cycle
- Both have been shown to decrease treatment side-effects

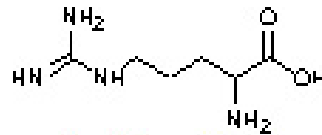
Amino Acids - Structure

Schematic diagrams of the 20 amino acids

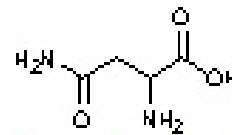
(picture taken from www.chemistry.pomona.edu)



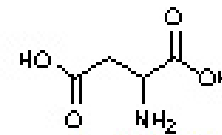
Alanine (**Ala**)



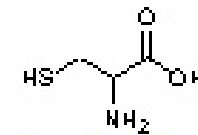
Arginine (**Arg**)



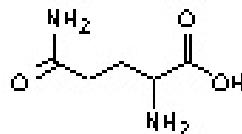
Asparagine (**Asn**)



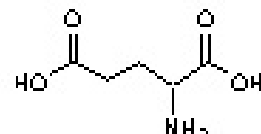
Aspartic Acid (**Asp**)



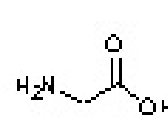
Cysteine (**Cys**)



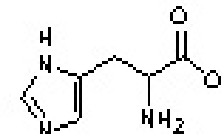
Glutamine (**Gln**)



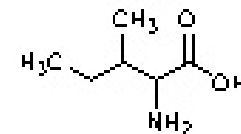
Glutamic Acid (**Glu**)



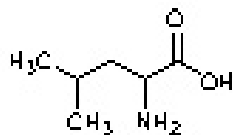
Glycine (**Gly**)



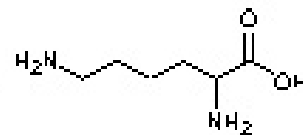
Histidine (**His**)



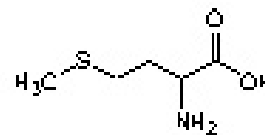
Isoleucine (**Ile**)



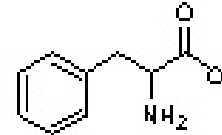
Leucine (**Leu**)



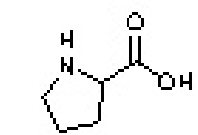
Lysine (**Lys**)



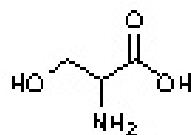
Methionine (**Met**)



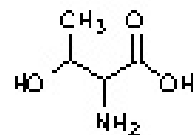
Phenylalanine (**Phe**)



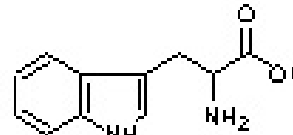
Proline (**Pro**)



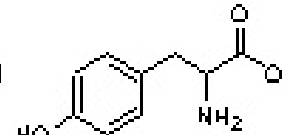
Serine (**Ser**)



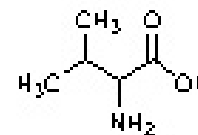
Threonine (**Thr**)



Tryptophan (**Trp**)

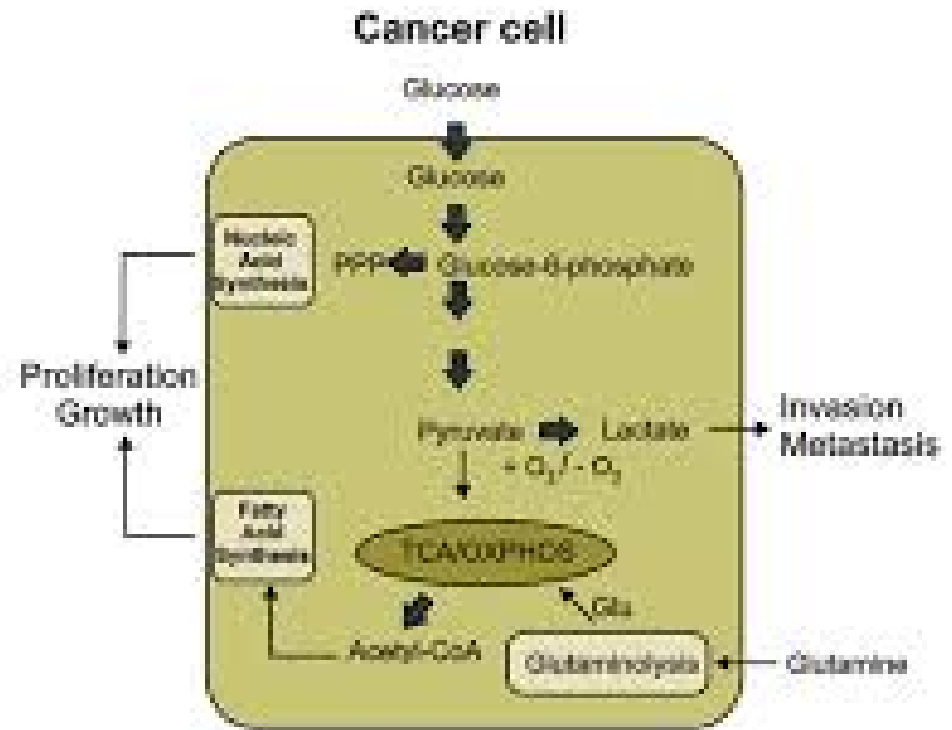
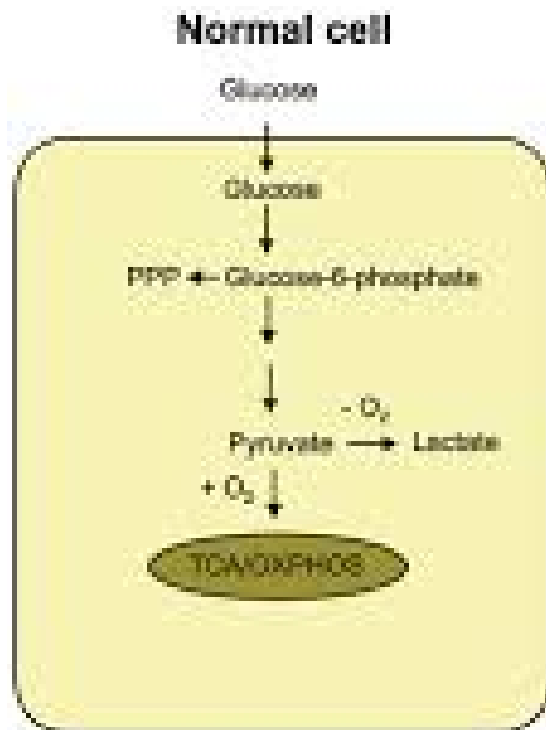


Tyrosine (**Tyr**)



Valine (**Val**)

Glutamine Use in the Body and Cancer



Arginine Studies

- Preclinical
- Rat
- Human

Glutamine Studies

- Human trials
 - Gut function
 - Critical Care Trials
- Mucositis – 1 Meta-analysis & 1 Systematic Review published in 2016
 - Chemotherapy
 - Radiation
 - Cancer type included

Mixed Nutrient Products

- Arginine/Glutamine/ β – Hydroxy β – Methylbutyrate (Arg/Gln/HMB)
 - 2 studies, propriety blend – dosage (Juven by Abbott Nutrition)
 - Available in U.S. and internationally
- Immunonutrition Product – Arginine, Fish Oil, Nucleotides
 - Chemoradiation, 1 study to date in esophageal patients
 - Prior studies have been as oral supplement and tube feeding products
 - Product utilized in study - Impact Advanced Recovery by Nestle Health Science

Anti-oxidants

- What are anti-oxidants?
 - How body counteracts an oxidative state
- Vitamins, Trace elements, Phytochemicals
 - Vitamins: Vitamin A (retinols and carotenoids), Beta-Carotene, Vitamin C (Ascorbic Acid), Vitamin E (Tocopherols)
 - Trace Elements: Selenium
 - Phytochemicals: plant derived, thousands in foods we eat, limited data on function and optimal dosage

Anti-oxidants – Theory & Use

- Cancer treatment biology
 - Primary oncology concern: counteract effects of chemotherapy and radiation, treatment creates a pro-oxidant environment
 - 2008 – first published study showing interaction: green tea and bleomycin, green tea diminished chemotherapy effectiveness
 - Benefits: multiple studies showing decreases treatment side-effects
 - Questions: dosage, timing, oxygenation of cells

MD Anderson Radiation Dietitians



Questions ???